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THE SURGICAL CLINICS
OF
NORTH AMERICA

Volume 8 Number 3

CLINIC OF DR. ARTHUR DEAN BEVAN

PRESBYTERIAN HOSPITAL

GASTRO-ENTEROSTOMY DISEASE

IT will be necessary for me to reoperate this morning on a case of gastro-enterostomy which I did about twenty days ago.

The patient, a man of forty-eight, had for a number of years more or less stomach distress. For a long time it has been necessary for him on account of retention to wash his stomach out at least once a day. This he usually does in the evening before he goes to sleep. His general condition has been fair. He is able to do the work of a professional man in a satisfactory way, but his stomach distress and the necessity of relieving it by washing it out every day became a great deal of annoyance to him and made him at least a partial invalid. He was under the observation of my colleague, Dr. Donald P. Abbott, for a considerable period.

Examination of the stomach with a motor meal showed a marked retention. Examination with the *x*-ray showed a very definite constriction in the duodenum just beyond the pylorus. I agreed with Dr. Abbott in going over the case that it was desirable to operate upon him and relieve, probably by gastro-enterostomy, the obstruction. This we did about twenty days ago. There was no difficulty about doing a posterior gastro-enterostomy with a short loop. An opening between the first part of the jejunum and the posterior surface of the stomach was made about $1\frac{3}{4}$ inches in length. Three rows of catgut suture were used in making the anastomosis. The pads and sponges were accounted for.

Wound healing seemed to be perfect. After operation the patient had no temperature. He was sitting up on the fifth day, shaving himself, and was delighted with the result of the operation. The sixth day, however, he began to have stomach distress and retention, and it was necessary to aspirate him. About 1000 c.c. were withdrawn. From that time on aspiration was necessary several times a day, and we finally were

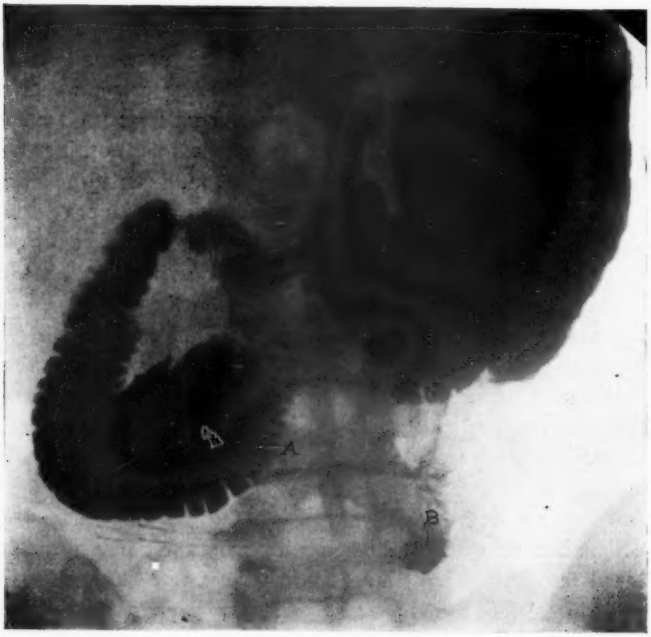

Fig. 166.—*A*, Duodenum. *B*, Jejunum below stoma.

compelled to place him on an eight-hour aspiration schedule. At one time we were aspirating him every six hours. I have had a great many similar experiences of retention and the necessity of aspirating the stomach after gastro-enterostomy operations. Usually in a few days the stomach finds itself and the new opening functions and the patient goes on to recovery. We have had some cases that were very persistent, but would

go on to complete recovery after three or four weeks of washing out the stomach after operation. It has been necessary for us in some cases to do an enterostomy, an anastomosis between the two loops of the jejunum involved in the gastro-enterostomy opening.

Dr. Abbott and I have studied this particular case with a great deal of care. About ten days after operation we took some

Fig. 167.—Rehfuss tube lying in duodenum with tip in gastro-enterostomy stoma.

x-ray views which showed apparently quite definitely a dilatation of the duodenum with an apparent obstruction at about the point where the superior mesenteric vessels cross the duodenum. We discussed the possibility of the necessity of doing a duodeno-jejunostomy to relieve this condition. Dr. Abbott then passed a Rehfuss tube and found that it went through the stomach into the duodenum, and through the duodenum into the stomach

again, completing a vicious circle, but apparently demonstrating that there was no obstruction in the duodenum itself (Figs. 166, 167). We finally concluded that because of the persistent vicious circle that exists in this case it is necessary to reoperate the patient.

I shall do this under the sequence of gas and ether. I shall first dissect out the scar of the first operation. I find the operative wound very thoroughly clean, and in the peritoneal cavity I find that the omentum is firmly adherent to the anterior parietal peritoneum. With, as you see, a great deal of difficulty I am very patiently separating the adhesions so as to separate the omentum from the parietal peritoneum and to bring

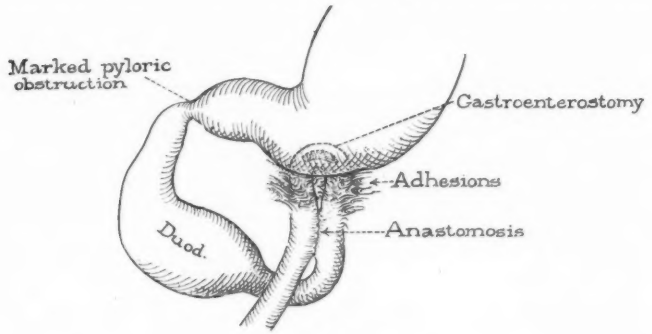

Fig. 168.

the stomach, duodenum, and colon into view. As I free these adhesions (Fig. 168) so that I can free the omentum and the transverse colon upward, I now come down to the gastroenterostomy union between the jejunum and the stomach. I find that here there has been a very extensive plastic peritonitis. All of the tissues seem to be covered with an opaque, thin layer of connective tissue the result of a reparative peritonitis which followed operation. He had at no time any evidence of infection, no temperature, no increased leukocyte count, so that I think we can accept this wide-spread plastic peritonitis as being due not to any infection, but a reparative plastic peritonitis due to the trauma of the operation. I find that this

plastic peritonitis surrounds both the proximal and distal segments of the jejunum, involving the end of the new stoma, and has produced so much constriction as to make most of the obstruction just below the stoma. Both the proximal and distal loops of jejunum below this point seem to be normal and of good size, and I am therefore going to do an entero-anastomosis between these two segments of the bowel with the hope and belief that this will relieve the situation.

I have now freed these two segments of bowel so that I can put an intestinal clamp on each one. I bring them together and am doing the usual side-to-side anastomosis just as we would make an anastomosis in a gastro-enterostomy. I am using here three rows of suture, the outer layer of Pagenstecher linen, the inner and intermediate layers being of fine catgut. It is, as you see, rather difficult to make this anastomosis because the field in which I have to work is so contracted. We have, however, now completed this part of the technic, and we shall now make the closure of the abdominal wall as we do in these cases with layer-to-layer closure with the addition of four sets of button tension sutures. I am, of course, very much in the hope that this will correct the condition and lead to cure in this man's case.

This patient is one of a very considerable number of cases in which we have had complications after gastro-enterostomy, and I should like to take this opportunity of discussing with you quite fully the subject which I think has not been sufficiently recognized or been sufficiently understood. I would like to use here a term which has been used before, but which possibly is not widely known. I should like to describe these cases under the head of "gastro-enterostomy disease," in the sense that there is a symptom-complex which is produced by the operation of gastro-enterostomy and its complications and results, and which is frequently cured by undoing the gastro-enterostomy and restoring the parts to the condition which they were in before the operation was done. Gastro-enterostomy disease includes a number of different complications. First, I should say that it includes the condition of vicious circle with continued vomiting,

this condition developing acutely after operation. Second, that it may occur as a vicious circle coming on after weeks or months following operation. Third, that it includes the condition of jejunal ulcer with the symptom-complex associated with this condition. Fourth, that it includes the general picture of stomach distress following gastro-enterostomy which leads to greater or less invalidism and disability which can be cured in no other way except by taking down the gastro-enterostomy and restoring the parts to normal. I would like to give you examples of these different pictures which we have had recently in our work.

First I shall show you a pathologic specimen from a post-mortem examination which was made only a few days ago. This case represents that type of gastro-enterostomy disease which might be classified as vicious circle coming on months after gastro-enterostomy. The patient, a man of about fifty-five, was brought to Dr. Ralph Brown by his attending surgeon from a western state. The patient was, I am quite sure, very well handled by a thoroughly trained internist who had treated him medically and by the surgeon who did the original operation. The history was that of the patient's coming under observation with a picture of pyloric obstruction and acute peptic ulcer which was first handled under the Sippy management, with some improvement, but without complete relief from the symptoms of pyloric obstruction. The *x*-ray showed quite definitely pyloric obstruction. The motor meal showed 1000 c.c. or more retention. After consultation the internist and the surgeon agreed that a gastro-enterostomy should be performed. This was done, and the result seemed to be most satisfactory. The patient regained 30 or 40 pounds in weight and was quite delighted with his recovery. Then he gradually commenced to have a return of the symptoms of distress and increasing retention, and for a period of about three weeks before he was brought to Dr. Ralph Brown's service he had a rather extreme picture of vicious circle with vomiting and had passed into a condition of acidosis from starvation.

I saw the case in consultation with Dr. Brown, and we agreed that nothing radical could be done and that probably the best

plan would be to attempt to save the patient's life by doing a jejunostomy and feeding him through a tube in the jejunum, sidetracking the stomach in this way. At the time of operation, after opening the peritoneal cavity and drawing out the colon and omentum, I examined the anastomosis between the jejunum and the stomach. I found that both the proximal and distal loops of the jejunum were driven up into the opening in the transverse mesocolon, apparently practically obstructing it at that point. This opening seemed to be very small. I told Dr. Brown that I felt that we could do an anterior gastro-enterostomy as easily as we could do a jejunostomy, and I was rather under the impression that if we succeeded in establishing a good functioning anterior gastro-enterostomy, we would relieve the symptoms of vicious circle and allow the contents of the stomach to pass freely into the jejunum. So, instead of doing a jejunostomy, I did an anterior gastro-enterostomy. After operation the patient did not improve. Practically the same condition existed as before operation, a very marked retention, no relief from the condition, and inability to nourish the patient. We had to pump out 2000 or 3000 c.c. of fluid every day from the stomach, getting, of course, bile and gastric juice and pancreatic and intestinal juice, with very little food particles. The patient went steadily downhill. I was called out of the city for a few days and my associate, Dr. Gatewood, in my absence and at the request of Dr. Brown reoperated the patient. He found that on account of the bad condition of the patient there was little evidence of repair at the gastro-enterostomy opening. There was nothing like a peritonitis. He, therefore, took down the anterior gastro-enterostomy opening and did a jejunostomy. This enabled us to introduce a lot of fluid and food into the intestinal tract and we were in hopes that the patient would improve. He did not however. The acidosis and starvation continued. He developed the tetany of inanition. The postmortem specimen which I show you is of great interest. Much to my surprise I find that, instead of a small contracted gastro-enterostomy opening, there is a perfectly enormous gastro-enterostomy opening about 9 inches in circumference (Fig. 169). There can be no doubt

that at the time I operated there was an invagination of the jejunum into this huge gastro-enterostomy opening preventing a proper functioning of the stoma. Another thing that is very interesting is that at the pylorus we find very beautifully shown a healed peptic ulcer about $1\frac{1}{4}$ inches long and $\frac{1}{2}$ inch wide right in the line of the pylorus; no pyloric obstruction whatever. In fact, the pylorus will admit three fingers. There was evidently at the time of the original gastro-enterostomy a pyloric

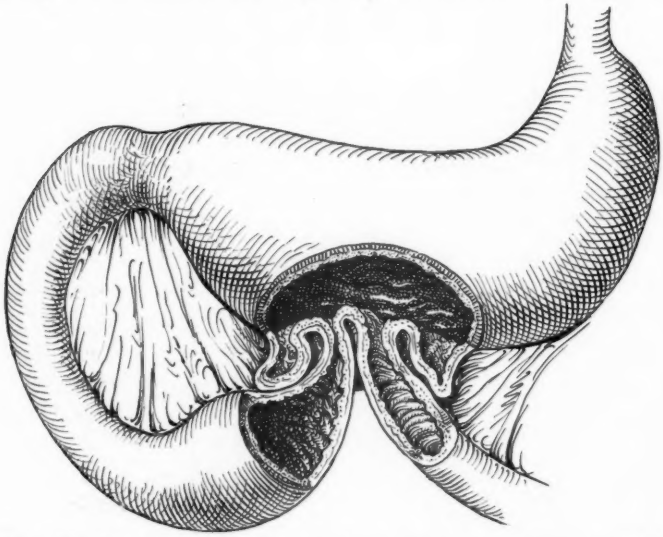

Fig. 169.—Invagination of jejunum about gastro-enterostomy stoma into stomach (Lewisohn from C. Henschen, Arch. Klin. Chir., 13,148).

obstruction from this large ulcer and from the edema and spasm which existed at that period in the man's history. In view of the postmortem findings it would seem that the one thing that would have saved this patient's life and would have cured him and probably cured him permanently of this condition was to have taken down the original posterior gastro-enterostomy, closing the stomach and jejunum. As there was no pyloric obstruction at that time, if the patient had survived the operation he would undoubtedly have had a return of normal function of

the stomach and jejunum. This invagination of the bowel into the gastro-enterostomy opening is one of the conditions that may occur in this gastro-enterostomy disease.

The third type of condition that should be noted is one in which after gastro-enterostomy the patient may improve for a time and then have a return of more or less indefinite stomach and intestinal symptoms which finally develop into outspoken evidence of ulcer with blood, ulcer distress, etc. In these cases frequently we find quite definite evidence of the development of ulcer at the stoma (Fig. 170), a jejunal ulcer. How frequently

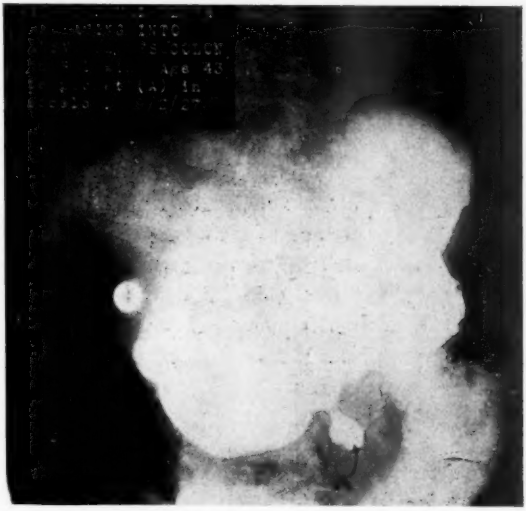

Fig. 170.—Gastrojejunal ulcer, *A*, perforating into transverse mesocolon.

this complication occurs after gastro-enterostomy is a question. It undoubtedly varies a great deal in different clinics and the statistics show that it varies all the way from 3 per cent. up to 15 or 20 per cent. Some of our German colleagues believe that it occurs so frequently that the risk of this complication almost eliminates gastro-enterostomy from consideration. I do not agree with this view. My impression is that jejunal ulcer has not occurred in certainly more than 2 or 3 per cent. of the

gastro-enterostomies that we have been able to trace in my own clinic. But that jejunal ulcer is a very definite possibility and a very definite risk must be recognized whenever we consider the employment of a gastro-enterostomy.

In the majority of these cases of jejunal ulcer the best hope of relief is to take down the gastro-enterostomy and, if there is no pyloric obstruction, to do nothing else. I am inclined to go very far with this proposition, and wherever possible in jejunal ulcer simply take down the gastro-enterostomy, and if there is any fair likelihood of the duodenum and pylorus being competent to carry on normal function and, unless they are very definitely obstructed, to do nothing further. Of course, if there is obstruction of the pylorus several things can be considered—a Heineke-Mikulicz or a Finney pyloroplasty or a Billroth I, removing the obstruction at the pylorus and uniting the jejunum with the stomach directly. In some cases also a Billroth II or Polya may have to be considered.

There is a fourth group which comes under the head of gastro-enterostomy disease in which the patient after gastro-enterostomy has more or less continued distress, no definite evidence of ulcer, but a condition of semi-invalidism persists with occasional vomiting, intermittent regurgitation, and more or less distress. After studying the case fully we cannot demonstrate either a jejunal ulcer or any evidence of pyloric obstruction, but the condition of the patient continues to drive him to seek medical aid. A secondary operation seems warranted in some of these cases and frequently reveals nothing in the way of recurrence of an ulcer in the duodenum or the development of a jejunal ulcer. Taking down the gastro-enterostomy is frequently followed by a cure of these patients. I want to emphasize this point because I believe there are a good many of these cases.

My own experience with gastro-enterostomy has been a rather satisfactory one. I believe that the operation has a wide field, that it is the operation of choice where we have an obstruction in the duodenum just beyond the pylorus which does not yield to medical management and where we have hemorrhage from a duodenal ulcer, and that it is curative in a very large

proportion of the cases. There is in this audience now one of my colleagues upon whom I did a gastro-enterostomy fifteen years ago because he had severe peptic ulcer symptoms and repeated massive hemorrhages. I am going to ask him to say a word in regard to his own experience.

DR. BEVAN: What has been your experience following your gastro-enterostomy? I remember that following operation you had a serious time of it for a week or ten days with a pulmonary infarct.

DR. M.: My experience has been most satisfactory. I had repeated massive hemorrhages before operation. I had a typical classical picture of peptic ulcer in the duodenum. Since my operation I have been in the best of health and able to carry a very heavy service, as you know, here in Presbyterian Hospital and in my private practice. *x*-Rays of my stomach which I have had taken several times show that both the gastro-enterostomy and the pyloric opening are functioning. I have no stomach distress and I have had no hemorrhages since operation.

DR. BEVAN: Just what proportion of gastro-enterostomies are satisfactory and just what proportion are followed by gastro-enterostomy disease is, I think, a problem. I should say, however, that where there has been a sound indication for gastro-enterostomy, as a pyloric obstruction or a hemorrhage from a duodenal ulcer, that the results are satisfactory in about 90 per cent. of the cases that recover; that the results are unsatisfactory in probably 10 per cent. Of this 10 per cent. I should say that somewhere from 3 to 5 per cent. are cases where a jejunal ulcer developed and the other 5 per cent. cases in which the operation did not succeed in curing the condition for which it was done—the cases in which there developed an acute or chronic vicious circle or one of these pictures of rather vague disability without massive hemorrhage or a definite evidence of recurrence of the ulcer or development of a jejunal ulcer with resulting invalidism, where it may be necessary for the patient to seek relief either by another operation or under continued medical management.

Postoperative History of Patient Operated Upon.—Following

the operation for a period of about three days it was necessary to wash the stomach out twice a day, and my medical colleagues and my own interns were rather discouraged with the outlook. On the third day, however, the enterostomy opening functioned very well, so that instead of 1500 or 2000 c.c. in twenty-four hours, we washed out about 400 c.c. from the stomach and the next day only 200 c.c. Then we began to feed the patient on semisolid food, giving him four meals a day about four hours apart, one meal consisting of oatmeal and cream, one of milk toast, one of a soft-boiled egg and toast, giving him at that time a small glass of half milk and cream. From that time on he improved very rapidly. At the end of twelve days the sutures were removed from the abdominal wound, which had completely healed, and the patient went on to a very complete recovery.

PERSISTENT FISTULÆ AFTER APPENDIX OPERATIONS

THE case which we shall operate upon this morning is a young woman of twenty-five who was operated upon at the Cook County Hospital about six months ago for an appendiceal abscess. She has had since operation a persistent fistula. The young woman is earning her own living and is without friends or family, and is in a state where her present condition is very pitiful. A few of her girl friends have clubbed together and sent her to our service, paying her way in the hospital, with the hope that another operation will restore her to health.

Yesterday afternoon I had Dr. Straus inject the fistula about the site of the appendix operation with 20 c.c. of lipiodol and take an *x*-ray picture. You see that in this *x*-ray plate (Fig. 171) there is shown a very interesting condition of affairs. The lipiodol enters the fistulous tract, passes backward, and apparently lodges in the posterior part of the pelvis about in the region of the sacro-iliac joint. It is evident that we shall have to make an extensive dissection in order to remove or to drain this extensive cavity. The question of the pathology is uncertain. Whether this abscess cavity and persistent fistula is due to a sponge that has been left in after the first operation or whether it is due to such a condition as a tuberculosis or actinomycosis is one that is difficult to decide. There has been recently no fecal discharge from the fistula.

I am going to attempt to make a wide dissection and if possible débride this entire fistulous tract or as much of it as possible. Beginning at the fistula, which is about at McBurney's point, I cut through the skin and superficial fascia and the three layers of the abdominal wall above the crest of the ilium, backward to a point opposite about the center of the crest, dissecting the normal structures off from this fistulous tract, and enter a large cavity which is lined with pyogenic membrane. This

pyogenic membrane is ¼ inch thick, a firm granulation tissue, and looks very much indeed like a tuberculous process from the appearance of the pyogenic membrane. I am able to re-

Fig. 171.—Tuberculosis abscess cavity following appendectomy. Catheter lying in sinus. Abscess outlined with lipiodol.

move, as you see, the entire wall of this large fistula and abscess cavity until I get back to the posterior portion of the pelvis, where I find that it is necessary in order for me to reach the end

of the cavity to make a counteropening in the back just above the sacro-iliac joint. The deepest point of the cavity posteriorly I curet out, as it is impossible for me to make here a complete dissection. I find nothing like a foreign body, such as a sponge or drainage-tube or fecal concretion. I find no evidence of a connection of this fistulous tract with the bowel. My impressions are that this is a tuberculous process, that the lesion of the appendix for which the primary appendectomy was done was probably tuberculous or probably a tuberculosis of the peritoneum associated with an acute appendicitis, and that we have to deal here with a cold abscess due to tuberculòsis. I have had a large number of similar cases. It is not at all uncommon to operate on a case with the diagnosis of acute or chronic appendicitis and find that either the primary process is tuberculous or that there is a tuberculosis associated with an acute pus infection, with the result that after operation a persistent fistula remains until it is cleaned up either by a second operation or by some method of treatment. The same thing is true of actinomycosis. We have had a large number of cases of actinomycosis of the cecum and appendix which were not recognized at the time the appendectomy was done with a resulting fistula which later was recognized as a ray-fungus infection.

The very fact that we have discovered a tuberculous lesion here makes it imperative for us to put this woman if possible in a condition where she shall build up her weight and strength and resistance against tuberculosis. If her circumstances permitted one of the best things would be to send her to a warm climate of Arizona or southern California for a period of six months or a year. If these arrangements cannot be made, it is possible that she could be given the benefit of fresh air and sunshine and building-up treatment even in this latitude of Chicago under less favorable conditions.

I am going to take this case as an example of a large number of cases of persistent fistula which we have dealt with after appendectomies. We have had a number of them recently in our service. A few weeks ago a girl was sent in with a persistent fistula after an appendectomy. We found on examining the

fistula first with lipiodol injection (Fig. 172) and then exploring it with a careful dissection under ethylene that it contained a drainage-tube about $1\frac{1}{2}$ inches long and a piece of gauze about

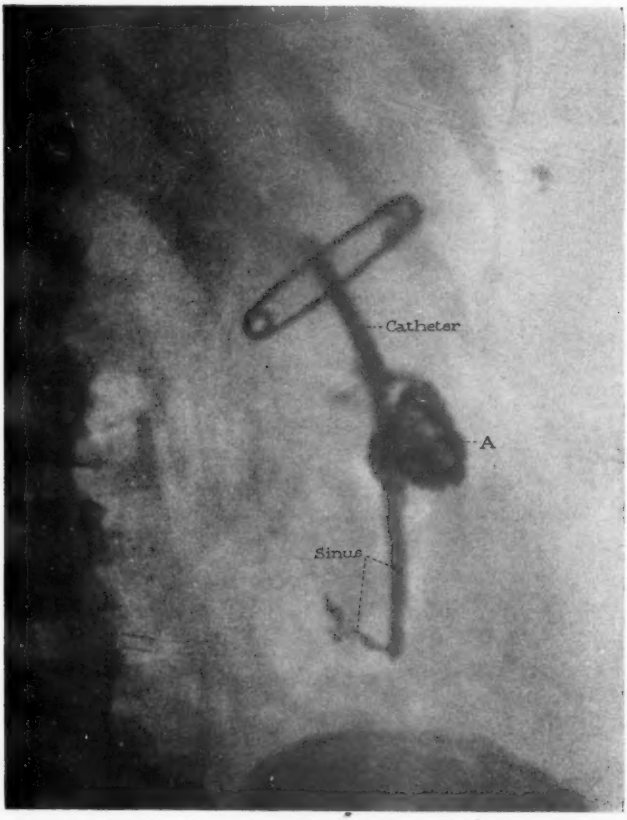

Fig. 172.—Fistula in abdominal wall, catheter lying in sinus. *A*, Gauze left in wound is foreign body, outlined with lipiodol.

as long as the last joint of my thumb. This healed up very promptly after removal of these foreign bodies.

Another case a few months ago is one operated on by one of my assistants with a fistula persisting after operation, and on

exploring it we found a piece of rubber tissue which evidently had been used as drainage material.

A number of other cases come to my mind which are interesting in connection with the discussion of this subject and are of service in making a diagnosis of some of these cases that come to us in the future. A high school girl of sixteen came to us last year with a persistent fistula after appendectomy. Her people were in very moderate circumstances. We examined it carefully and could find no foreign body. We could find no connection with the bowel. It was very persistent and refused to heal, so we employed in this case the sunshine treatment. We put this girl on a sleeping porch, exposed her arms and legs to the sunshine, and finally the abdomen, increasing the dose of sunshine a little from week to week until she was as brown as a mulatto. She began to pick up very rapidly under this sunlight treatment, gained 20 or 30 pounds in weight, the very free discharge diminished and finally disappeared entirely, and at the end of about three months she went on to a complete recovery.

There can be no doubt that where the etiologic factor is tuberculosis these cases are best handled by fresh air, sunshine, and building up the resistance of the patient.

Another case comes to my mind, one of persistent fistula, which was operated upon in the Mayo Clinic with a diagnosis of actinomycosis. The patient came to me and I made two further operations. The primary operation had been for an appendectomy before she went to Rochester. There she was operated on for a persistent fistula which was recognized as due to actinomycosis. My operation consisted of curetting out several fistulæ and opening abscesses. The poor woman, however, went steadily downhill and finally developed symptoms of partial obstruction, and she seemed almost in a hopeless condition. I was going to California about that time and I suggested that she go to Pasadena and try the sunshine and fresh-air treatment. They arranged to do this and took a little bungalow on the outskirts of Pasadena. She took sun baths, increasing the length of exposure every day until she was thoroughly sun burned. Within a few weeks she began to pick up in weight and

strength and, very much to my surprise, under the sunbath treatment she went on to a complete recovery from the abdominal actinomycosis. The discharge gradually diminished and within six months she had picked up 52 pounds in weight. The abdominal fistulæ all closed and she went on to a complete cure and was later able to come back to her home in Wisconsin. I think this case is most important and shows how important in even such a lesion as actinomycosis sunlight, fresh air, and building-up treatment are.

There is another group of persistent fistulæ after appendectomy which should be studied and which must be taken into consideration in making a diagnosis as to the cause of these fistulæ, a group in which we have left in the abdomen fecal concretions from the appendix. I have had a large number of these cases where secondary operation has shown at the bottom of the fistula one or more fecal concretions, and where, after the removal of these concretions, the patient would go on to a complete recovery.

There is another group in which we have fistulæ connected with the bowel, and these form a very interesting and important problem. I handle these in one of two ways, one the use of Beck's bismuth paste, the other method has been a dissecting out of the fistulous tract, bringing the opening in the bowel up to the surface of the wound, so that it can be completely closed by a purse-string suture, removing radically in this way the entire tract, closing the opening, and bringing about a cure. The method of using bismuth paste is one which can be very often used to very good advantage. I will give you an illustration: A boy, the ten-year-old son of one of my friends, suffered from an infected appendix. The boy had been sick for a week or ten days when I saw him. The condition was rather obscure. There were few abdominal symptoms. The boy had vomited, had great distress on urinating and on defecation, and a very constant desire to urinate and defecate. I found when I first saw him that on rectal examination I could make out a tumor between the rectum and bladder coming down almost to the sphincter. This proved to be an appendiceal abscess due to a

very long appendix occupying a position between the rectum and the bladder. Perforation had occurred and this abscess had formed entirely in the pelvis. I operated at once, drained the abscess, and removed the appendix. The boy made a very good operative recovery, but a persistent fistula resulted, with at first a little fecal matter and finally simple mucus with a fecal odor. A probe went down from the appendectomy wound in the abdomen deep into the pelvis. I hesitated about doing a second extensive operation, and finally, finding the point of injury to the bowel wall, I injected about ½ dram of Beck's paste into the fistula. At the end of about four weeks a complete cessation occurred in the mucous discharge and the boy went on to a permanent recovery.

Several other unusual conditions have occurred in cases of this kind which I have handled. One was a persistent fistula after an appendectomy which showed the presence of a pin about 1¼ inches long in the *x*-ray. The location of the pin was apparently deep in the posterior portion of the right iliac fossa. A careful dissection was made, and it was found that this pin was surrounded by a fecal concretion. It was in a retroperitoneal position and was almost certainly due to the fact that the pin had passed into the appendix and a fecal concretion had developed about it. A perforation of the appendix had occurred with the formation of a huge abscess. The abscess had been drained, but the persistent fistula resulted because of the presence of the pin surrounded by a fecal concretion.

Another type of case is interesting and illustrated by the following: The patient, a woman of thirty-five, was operated on for appendicitis and the appendix removed. Following operation she went on apparently to a good recovery. This was followed, however, in three or four months by another acute attack with abscess and persistent fistula. At the second operation I found at the bottom of the persistent fistula about 1 inch of the terminal end of the appendix lying completely separated from the cecum without any attachment to the bowel at all. It contained some mucous membrane in the center and a small fecal concretion, and was removed from the surrounding tissue

to which it was firmly attached with a good deal of difficulty. Evidently at the time of operation a part of the appendix was left by the operator, the main portion of the appendix was removed and the appendiceal opening in the cecum closed successfully, but this persistent fistula was due to the leaving of the terminal end of the appendix which probably had sloughed off from the main appendix.

There is another type of persistent fistula in connection with appendectomy that is not very common, but which does occasionally occur, and that is, a fistula following an appendectomy done for apparently an acute appendicitis which the after-history proves had developed in a carcinoma of the appendix. An abscess may be found, the thickened appendix removed, a persistent fistula follow, and weeks and months later after the condition has persisted there may develop such a mass at the site of the lesion that another operation is performed and a carcinoma is found. This is not common, but it does occur sufficiently frequent to make it very desirable in these thick-walled appendices to have a very careful histologic examination to determine the possibility of such a condition.

After-history.—The specimen removed at the time of operation in the first patient was examined microscopically and found to contain definite evidence of tuberculous caseation and giant-cells. The patient made a very good recovery, the wound fortunately healing up completely.

PERICOLITIS WITH ADHESIONS SIMULATING CARCINOMA OF THE COLON

THE patient upon whom we shall operate today is a very interesting case. It is a female seen by my colleagues, Drs. Post and Thomas, a woman between fifty and sixty. Her general health has been good until comparatively recently. She has had more or less disturbance of the large intestine with occult blood found in the stools. Because of this fact she was brought to the hospital, and a careful examination and *x*-ray plate made of the colon by injecting barium solution from below. This showed a very definite filling defect (Fig. 173) about 2 inches below the splenic flexure. I saw the patient in consultation with my medical colleagues and the evidence seemed almost conclusive that she had a carcinoma of the colon just below the splenic flexure. We decided to operate upon her, and as a preliminary stage did an appendicostomy as she had a good deal of bowel disturbance, and I thought this would increase very much her chances of recovery after resection of the colon. This morning we shall make a resection of the bowel.

I shall try to do this under local and ethylene and, if necessary, we shall add the sequence of ether. On opening the peritoneal cavity I find great distention of the transverse colon. You see it blows out into view to a diameter of $2\frac{1}{2}$ or 3 inches. On the right of the median line as I lift out the transverse colon I find an adhesion of a fat tab, making a rather deep groove in the greatly distended bowel. You can see this as I pick it up. I shall divide this between two forceps and ligate off this adhesion. I now bring the splenic flexure into view; this is the area where the very definite filling defect is found in the *x*-ray. Very much to my surprise I do not find any carcinoma here, but I find a strong adhesion which makes a sharp angulation at the exact point where we see the filling defect in the *x*-ray (Fig. 174). You will see here that the bowel is hooked over this

definite adhesion in much the same way that a kinked ureter is over the renal artery in some of these cases of hydronephrosis. I want you to look at this carefully because it is a very unusual condition and one which should be thought of at any rate as a possibility in filling defects of the large bowel. I divide this adhesion between two clamps, and at once the bowel fills out at this point to quite the same size as the transverse colon.

Fig. 173.—Colon showing filling defects at *A* and *B*.

We are exceedingly fortunate in this case that we have not carcinoma to deal with. I must, however, make further exploration here to make sure that this is all the pathology that we have in this abdomen. Passing my hand down into the pelvis I find a very small contracted uterus and nothing wrong with the tubes and ovaries. Passing my hand down toward the

descending colon and the cecum I find a rather significant situation, a thickening of the mesentery of the cecum and some edema, and I trace this right down to my appendicostomy. At the time I made the appendicostomy a week ago there was no evidence of any thickening of this kind, and I am forced to the conclusion that this edema is due to the trauma of the appendicostomy operation. The great dilatation of the bowel makes it rather difficult to close this abdomen. I want you to watch this technic that is employed in returning these greatly distended

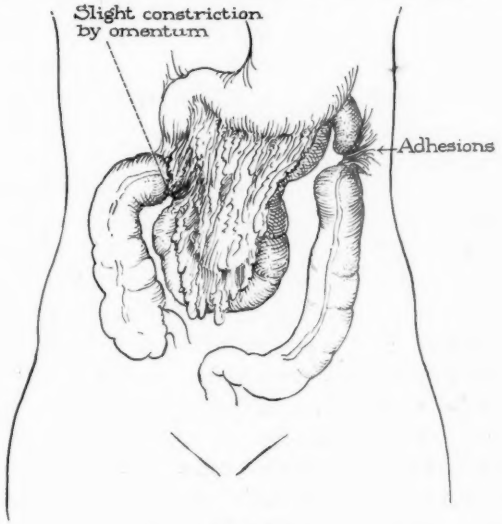

Fig. 174.

loops of intestine into the peritoneal cavity. I take a good sized wet towel and cover over all of the prolapsed stomach and intestine, then tuck the edges of the towel inside of the peritoneal cavity all the way around. Now I can gradually continue tucking the edge of the towel into the peritoneal cavity until I replace all of these structures into the peritoneal cavity, and then, as you notice, with a good deal of difficulty, we are closing the abdominal incision. This difficulty is due to the marked distention present. I am using here five sets of button

sutures and six interrupted silkworm-gut sutures, making a separate closure of the posterior sheath and peritoneum and then one of the anterior sheaths of the rectus, then making a very accurate approximation of the integument with interrupted silk.

What is the cause of the adhesion in this case? Most certainly this woman has a colitis which accounts for the blood in the stools. Most certainly the adhesions are due to a pericolitis and a little local peritonitis secondary to a lesion beginning in the mucous membrane of the colon and then gradually extending through the walls of the intestine. That sort of condition we meet with not infrequently, especially in cases where the sigmoid is involved. Adhesions in the sigmoid secondary to diverticulitis and peridiverticulitis are very common conditions met with in the abdominal tract.

I think this case is a very instructive one. Here we have apparently after very careful scientific investigation definite evidence of the clinical picture of carcinoma. Because of the continued blood in the stool, because of the definite filling defect seen on fluoroscopic examination and in the *x*-ray plate of a lesion in the descending colon which seems to be about $1\frac{1}{2}$ inches in extent, it in all human probability in a woman of fifty-five would be a carcinoma, and yet we have right here this morning a demonstration of the fact that this very picture can be produced by a pericolitis with adhesions. Such a case is no argument against the proposition that medicine is today a science. It is, I believe, just as definite a science as chemistry or physics. This case has been handled by scientific measures up to the point of a working hypothesis, which is the clinical diagnosis upon which the suggestion of operative therapy is based. At the time that we proceeded to institute our operative therapy we find on exploration of the abdomen that our working hypothesis is not correct, but we do in a scientific way demonstrate very definitely the pathologic condition which produced the symptoms in this case and relieve it at the same time.

CLINIC OF DR. KELLOGG SPEED

PRESBYTERIAN HOSPITAL

ACUTE EPIPHYSITIS OF THE FEMUR

ACUTE infections of the capital epiphysis of the femur, including the pathology, symptoms, and treatment, will be discussed along with illustrative cases. The relationship of Legg-Perthes' disease to this type of infection is considered.

Case I.—The patient before us is a colored girl sixteen years old, admitted to my surgical ward on January 18, 1928. Four days before admission, while on her way to school, she suddenly felt a sharp pain in the right thigh; weight bearing and walking increased the pain. She had previously been in good health.

On admission to the hospital a diagnosis of acute appendicitis was made because her complaint was of continuous severe pain in the right thigh and right lower quadrant of the abdomen. Her bowels had moved each day since the onset, having been forced by cathartics. An examination showed considerable rigidity in both lower quadrants of the abdomen, most marked on the right side, 1 inch above Poupart's ligament and in the general vicinity of McBurney's point. In addition, there was pain and tenderness in the right popliteal space, but no edema or unusual warmth was found in this leg. There was no history of chills, vomiting, or cough. Intercourse was not denied, and a vaginal examination showed a whitish discharge, smear of which failed to show any intracellular organisms. The urine contained only a few pus-cells. The Fallopian tubes both seemed tender. The last menstrual period ended January 4, 1928. Her temperature was 101° F., pulse 110, respiration 24, and a white blood-count showed 19,000 cells with a polymorphonuclear leukocytosis.

The senior intern reviewed these findings, only to confirm them, and a diagnosis was made of acute appendicitis, although salpingitis was considered. The patient was placed in Fowler's position, given liquid petrolatum by mouth, and an ice-bag was placed on the abdomen.

The day after admission the case was reviewed; a gynecologist said the pelvis contained no pathology, the vaginal smear was again negative, and it was found that the right thigh measured 1 cm. more in circumference than the left. There was tenderness in the right Scarpa's triangle and popliteal space. An *x*-ray examination was made of the right hip and knee and no abnormal findings were reported.

On January 21st I saw the girl and was able to demonstrate distinct tenderness in the right hip with limitation of motion, other findings remaining as described.

Exploration of the right hip was advised and performed later by another doctor.

Under ether an exploratory needle attached to a syringe was passed in toward the right hip-joint, starting about 2 cm. below the greater trochanter of the femur, passing obliquely upward along the neck of the femur into the hip-joint. About 20 c.c. of pus were obtained from the hip-joint, in which later no organisms could be found and from which none could be grown. An incision was made over the greater trochanter and the capsule of the hip-joint opened, more pus escaping. The periosteum and capsular attachments were then stripped from the anterior surface of the femoral neck and the bone of the neck was drilled and chiseled, opening a hole into which a probe could be passed down into the medullary cavity of the shaft. No pus was found here. A drain was inserted along the femoral neck and the wound left open.

Following operation the patient continued to run a septic course; the temperature varied from 99° to 102° F. By February 2, 1928 her temperature had fallen to 99° F. each day and she was improved. Her right leg then lay in adduction and hip-joint motions were limited and still painful, although much improved over the original condition.

Case II.—About this time a boy nine years old was admitted to the medical service on January 13, 1928. The history obtained was that five days before entrance he fell on the ice while playing and hurt his left hip region. He walked home, but limped. The next day he could not walk on account of pain in this hip, but had to be carried; a physician was called and found a temperature of 104° F. The boy grew worse and became delirious, in which condition he remained for two days prior to hospital entrance, complaining all the time of pain in the left thigh.

On admission to the hospital his temperature was 101° F., pulse 140, respirations 30. The white blood-cell count was 6400 with 63 per cent. polymorphonuclear cells. The examination showed large red tonsils, a distended abdomen, pain and tenderness about the symphysis pubis extending toward and down the left thigh. Passive movements of the left thigh caused pain reaction; there were no active movements of this leg. His white blood-cells rose to 7000, a blood-culture gave no colonies, and an *x*-ray examination of the thigh and hip region gave no abnormal findings. An attempt was made to aspirate fluid from the thigh with a syringe and needle, but nothing was obtained. His urine was normal. Fluids were pushed to overcome his dehydration.

On the eighth day after onset a surgeon examined the boy and diagnosed osteomyelitis of the left femur. The thigh was opened, the femur exposed, and the periosteum cut open, but the cortex was not touched. No pus was found, but serosanguineous fluid was obtained which gave staphylococcus on culture. Following operation the child's delirium and toxicity continued and his fever ranged from 102° to 105° F.

Three days later I saw the child. The white blood-cell count was 16,500. A diagnosis of acute epiphysitis of the capital epiphysis of the femur was made and it was decided to open the hip-joint and drain. This was done and some thin serous pus was obtained for culture. This grew staphylococcus. The patient continued to be delirious; purpuric spots appeared on the body, and exitus followed in four days—January 21, 1928.

Inasmuch as there had been a traumatic history at the onset, the postmortem fell into the coroner's hands and no report could be obtained.

Going back over my recent records, the following additional cases of this interesting type of infection are found:

Case III.—H. B., male, twelve years old, seen April 6, 1925. Three weeks before he had an abrasion on the right knee which had become infected. He had evidence of lymphangitis in the right thigh, high fever, leukocytosis, and septicemia. His condition became worse under palliative treatment and he developed severe pain and tenderness in the right thigh and hip region. On April 18, 1925 the thigh was opened and the femur was explored clear up to the trochanters; no pus or infection was found, although cultures were taken from the bone. *x*-Ray examination gave no helpful information. By May 2, 1925 his pain became more definitely localized in the right hip-joint; the leg was put in suspension traction. No real relief of pain or fever was obtained, and on May 18, 1925 the right hip-joint was opened by an anterior incision, pus was found in the joint with beginning destruction of the head of the femur and acetabular surface. A pure culture of streptococcus was obtained.

His serious symptoms improved rapidly except for an attack of acute pain in the right shoulder, which caused a secondary rise of temperature to 102° F., but no swelling or fluctuation developed. His hip-joint was irrigated with Dakin's solution and later was drained posteriorly when the roentgenogram showed positive changes in the head of the femur.

During this time there was great loss of weight and strength until the patient looked like a skeleton. After several weeks he was placed in a body plaster encasement with the right leg abducted. The wounds were dressed through appropriate windows in the plaster. Some five months after the onset he was taken home in his plaster and with the help of an outdoor porch and high calorie diet made a slow recovery.

On February 26, 1926 his right leg was 1 inch shorter than the left. The knee and ankle motions were normal. His hip

was firmly and bony ankylosed in 30 degrees abduction. He weighed 100 pounds, as compared to 110 pounds before he was taken sick a year before. He was able to walk about 5 blocks with the help of a cane, but then became tired; no shortness of breath. He was not able to return to school until September, 1926.

In September, 1927 he had gained nearly 40 pounds, and was able to run about and had gained much weight. The legs showed less than $\frac{1}{2}$ inch difference in length, his right hip was completely and painlessly ankylosed, and his general health was excellent. A roentgenogram of the right hip did not show any sequestra or bone abscess; the hip was ankylosed in the acetabulum with much absorption of the head of the femur.

Case IV.—Carl L., eighteen years old, was seen on January 11, 1926. He was taken sick December 6, 1925, about which time he had been having a series of boils. While at work he had to make a sudden jump down from a beam of about 30 inches to the ground. Some injury to the left hip seemed to develop. High fever with pain in the left hip followed. He was taken to a hospital, treated with hot applications in the hip, and left after a few days' rest in bed with some subsidence of symptoms.

Within four days he had to be returned to the hospital, as the exertion of going home caused more hip pain and fever. An abscess about the hip was then diagnosed and drained by a physician. A roentgenogram at this time showed involvement of the head of the left femur and part of the ilium—the hip-joint itself had not been drained, but a culture of staphylococcus had been obtained from the abscess about the hip-joint. When seen by me his temperature was 105° F. In addition to the painful draining hip, with positive *x*-ray findings of acute epiphysitis of the head of the bone, he had an infected swollen undrained left knee, a large sacral bed-sore, and was plainly in an advanced stage of septicemia. He had suffered great loss of weight and could be moved only with the greatest difficulty. No active surgical treatment was advised. Death followed in a few days.

Case V.—W. Z., aged twelve and a half years. Seen on September 20, 1926 with a history that about April 5, 1926 he had suffered from a stoppage of urine, with severe pain in the right side or hip region and high fever. Physicians who saw him diagnosed acute appendicitis and he was taken to a hospital for the purpose of operation. For some reason the operation was postponed; his condition became worse, his temperature rose over 105° F., and finally an abscess was diagnosed in this right hip region which was opened and drained.

He remained in bed in dorsal decubitus. Pressure sores developed over the sacrum and became infected. His right hip underwent pathologic dislocation backward. Pressure sores developed on the left hip and involved the trochanter of the left femur. That hip also went into posterior pathologic dislocation.

After three months he was reduced to a mere skeleton in weight, could not move either leg, and as both heels had undergone pressure necrosis along with an epiphyseal separation of the lower epiphysis of the right tibia, he was in a pitiable condition. Practically the whole lower half of his back was denuded of soft parts.

As his parents had exhausted their means to keep him in a hospital, he was then taken home. His mother decided to turn him permanently on his face, which she did, and dressed his back and heels with Dakin's solution. During his period of prone position it became difficult for him to urinate on account of the pain from movement. He consequently had constant involuntaries of retention and his bladder became infected. The skin over the hypogastrium and both patellar regions next became necrotic from pressure.

At this point I saw him—September 20, 1926. He was taken to the Presbyterian Hospital and placed on a water-bed in prone position. An arrangenent was made with a cut-off rubber finger-cot slipped over the penis to carry all urine to a bedside bottle and to give him a dry bed. Knees and hypogastrium were dressed and cleansed and slowly healed. His back, meantime, was Dakinized and ultimately strapped with adhesive tape so

that it began to heal, and under forced feeding he regained weight. Later, he was placed, still prone, in a wheel chair which he learned to steer in that position. After several months in the hospital a flap from his back was turned down over the denuded sacrum. This healed satisfactorily in place.

In November, 1927 his knees, heels, and back were healed. Both hips were still in pathologic dislocation with adducted legs and he had little ability to stand upright. Roentgenogram showed no sequestra in the femora, the head of the right femur had been completely dissolved, and both hips were ankylosed in their new position.

The back has entirely healed, and he is now ready for a subtrochanteric osteotomy first on one hip, then the other, to bring his legs into abduction and give him a base on which to support weight, that he may get about on crutches.

Case VI.—W. W., male, aged twelve years. Early in 1925 he had an infection on his right leg from an abrasion. Acute epiphysitis of the left hip followed, but was not recognized and not drained. The head of the femur became dead, a pathologic dislocation of this left femur and attached dead head followed, other abscesses in the body developed, and the boy nearly passed on in spite of blood transfusion and other care.

He was seen by me on July 1, 1927, two and one-half years after the start of his trouble—underweight, a draining sinus in the left hip region, his left leg 4 inches short, and his left hip in posterior dislocation.

On July 20, 1927 through a Smith-Petersen incision the hip region was opened; the greater trochanter, still cartilaginous, was cut through with a knife and the neck of the femur was turned out into view. The head of the femur was still present, lying as a shell of dead bone in the new acetabulum formed on the side of the ilium. This dead bone was removed, the adventitious acetabulum and neck of the femur were cleaned of granulations and sharpened slightly, the thigh was brought into 30 degrees abduction, the wound was closed after iodization, and a body plaster-of-Paris encasement was applied.

The wound healed with very little discharge. A second plaster spica with the hip in abduction was substituted six weeks later and the boy was allowed to become ambulatory in plaster to get out-of-doors. He gained weight and strength immediately after operation and is now going to school in an abduction caliper.

In January, 1928 roentgenogram and clinical examinations showed a bony ankylosis of femoral neck to ilium. His leg is 3 inches shorter than its fellow leg.

Case VII.—J. M., male, aged four years, was taken acutely ill late in August, 1927. He complained of pain in the right thigh and leg; had vomiting at the onset, and a temperature of 102° F.

Ten days later, on September 5, 1927, he was admitted to the Presbyterian Hospital, at which time there was tenderness and rigidity in the right lower quadrant of the abdomen, pain on any movement of the right leg referred to the hip region, and so much muscle spasm that movements of the right hip were impossible. His temperature was 103° F.; white blood-cells 35,750. Around the right hip and upper third of the thigh there was some swelling, but no redness, no induration. The roentgenogram gave no positive findings. After two days a tender mass became palpable above Poupart's ligament on the right side. Aspiration at a point just mesial to the anterior superior spine of the ilium obtained pus. An incision was made by a surgeon along the tract of this needle puncture and 50 c.c. of pus were allowed to escape. A drainage-tube was inserted. The next day the white blood-cells were 29,850; urine normal. Culture of the pus grew a hemolytic streptococcus.

The patient was discharged from the hospital September 29, 1927 still showing a slight daily fever and with some drainage from the wound.

On October 6, 1927 he was readmitted to the hospital with a temperature of 102° F., white blood-count 11,200, pain and stiffness in the right hip-joint. The discharging sinus along Poupart's ligament on the right side was nearly closed. A roentgenogram at this time showed changes involving the upper

epiphysis of the right femur. There was mottling in the upper portion of the diaphysis, some separation at the epiphyseal plane, and sequestration in the head fragment.

On October 7, 1927 through a Smith-Petersen incision I exposed the trochanter of the femur, which was resected by a knife and retracted. The neck of the femur was rotated out and a full view of the destroyed head and the acetabulum was had. The head had almost entirely disintegrated; the neck was covered with granulations and some new bone formation thickened it. No deep abscess or other change was found in the neck, which was wiped off, the acetabulum was wiped clean of granulations, and the neck was thrust back into it. The trochanter was reapplied with catgut sutures, while the leg was held in abduction and slight inversion. A body plaster encasement was applied, maintaining this position.

This operative wound healed with no discharge of pus; the original sinus of the first operation closed; temperature subsided to normal. After five weeks the body plaster was removed. There was no sinus, no discharge, temperature was normal, and about one-fifth a normal range of painless motion in the hip-joint existed. A Bradford double abduction splint was ordered, and weight bearing with crutches started. In January, 1928 the walking caliper splint was discarded. There was no sinus; no pain.

Case VIII.—G. M., aged twelve, admitted to the County Hospital on October 27, 1927 with a history of an insidious onset with headache, fever, vomiting, chills, first limping, and then with severe pain in the left hip of five days' duration. Her temperature had ranged from 101° to 105° F. The roentgenogram showed no bony change. She was operated upon by a surgeon who opened the left thigh just below the neck of the femur and obtained some very thin pus. Her condition and pain did not improve very much.

On November 9, 1927 I diagnosed acute epiphysitis of the upper end of the right femur and opened the hip-joint, finding pus there and feeling with the index-finger evidence of bony

change in the epiphysis. A counter-drainage was made posteriorly. The patient was put in a body plaster of Paris with both legs abducted.

After operation the temperature fell to 99° F. and the pain subsided. The joint and bone were irrigated with Dakin's solution. Culture showed a staphylococcus.

In January, 1928 two sequestra were removed from the head of the femur and a new plaster encasement was applied, with the legs in 30 degrees abduction. The infection has spread into the ilium, as shown by the roentgenogram.

Case IX.—L. D., four years old, was admitted to the Cook County Hospital on August 21, 1927 on my service, with a history of pain in and loss of use of the right hip of eight days' duration. At first she had been able to walk with a limp, but later could bear no weight on the leg and was kept in bed with the hip and leg flexed. Her temperature had been at least 100° F., but was only taken once. On admission it was 101° F. There was flexion of the right hip, pain on any attempts at manipulation or straightening of the leg, white blood-count 43,200, but no external evidence of swelling about the hip-joint. After four days the temperature fell to 99° F. and there was less complaint of pain.

On August 30, 1927 she was examined again, and acute epiphysitis of the upper end of the femur diagnosed. On account of the apparent subsiding character of the infection after so many days and an utterly useless roentgenogram, drainage of the hip was not advocated.

On September 1, 1927 the patient was put in a body plaster encasement with legs in 30 degrees abduction. After this manipulation her fever rose again, and on September 8, 1927 was 101° F. There was still no satisfactory roentgenogram. By September 16, 1927 she became afebrile and was sent home in plaster September 21, 1927.

On October 11, 1927 she was readmitted. The plaster was removed and nearly a full range of hip-joint motion without pain was found. A roentgenogram failed to show any joint destruc-

tion or new bone formation in the hip-joint, but the head of the femur was fragmented. A walking caliper was ordered and the child kept under observation.

In January, 1928 the caliper was removed; the hip was more than one-half normally movable with some flattening of the head of the femur seen in the roentgenogram.

Is such a subacute epiphysitis the forerunner of a real Legg's disease? Unfortunately, there is no actual demonstration of pus or organisms in the hip-joint.

Case X.—W. A., aged sixteen, was sent to the writer September 22, 1927. At six months of age he had an infection in his neck, which burst and discharged freely. Within a few days his right thigh began to contract, he had an acute fever, and apparent pain in the right hip. One week later an abscess in the right hip burst open and drained itself. After these intervening years he has good musculature in the right thigh and leg, but has always been lame in that leg. There are found a few degrees of active flexion, slight adduction, and no abduction in the right hip. A small scar of the old drainage still exists just below the gluteal fold on the right side.

A roentgenogram shows that the shaft of the right femur is smaller than the left, the head has all been absorbed, and the neck of the femur is shortened, dislocated upward and backward from the acetabulum. No sequestration, bone abscess, or active infectious process is to be found. The right leg measured $3\frac{1}{2}$ inches shorter than the left.

No active treatment was accepted by the patient's family.

Case XI.—L. T., twelve years old, was seen March 29, 1927. Four or five weeks before he had been having some fever and had begun to limp on his right leg. Two weeks later he fell and probably separated the upper epiphysis of his right femur, causing epiphyseolysis. He was treated by a chiropractor, without improvement. The boy was quite fat, but had an average genital development. His right leg was $1\frac{1}{2}$ inches shorter than the left, the trochanteric portion was displaced upward, and the foot was everted. There was little evidence of bone absorption.

I reduced the displacement by manual extension, traction, inversion, and abduction, followed by the application of body plaster. After this reduction the boy ran a daily fever up as high as 100° F. for some time.

Twelve weeks later he was removed from the plaster and a walking caliper was fitted to this right leg. A roentgenogram at that time showed some mottling of the upper end of the diaphysis and fissure in the head of the femur, but the reduction still held. Since that time—July 17, 1927—the boy has not been seen, but the case gave every expectancy of continued bone change which might eventually assume the aspect of a Legg-Perthes' disease.

Case XII.—W. G., twelve years old, seen July 15, 1925 with a history that in January, 1925 he hurt his right hip when he fell while skating, and he limped after that a little. He was a heavy boy, much like the one in Case XI. On July 4, 1925, while wrestling with an uncle, he had a sudden pain in the right hip, fell to the floor, and could not get up or walk.. He was taken to a hospital where an ambulatory splint was applied after roentgenogram which showed an epiphyseolysis at the upper end of the right femur. I saw him eleven days later, and after removing the ambulatory splint demonstrated that there was $1\frac{1}{4}$ inches shortening and the roentgenogram betrayed the fact that the epiphyseal separation had not been reduced, and that there was little if any other bone pathology to be seen.

Accordingly, as in the preceding case, the displacement was reduced and put in plaster. A roentgenogram showed complete reduction.

The boy remained in plaster until October, 1925, after which he had guarded use of his leg and wore a walking caliper for many months, several roentgenograms showing the position of the femoral neck to be unchanging. In October, 1926, the caliper having been discarded, he was sent to a military school where he was plunged into an unusual amount of drilling and exercises, although he had been a very active boy.

On October 24, 1926 he was returned to me shortly after a

fall during drill. At that time the neck showed some bending, coxa vara, some new bone formation at the epiphysis, and mottling in the head—no further epiphyseolysis or fracture. The walking caliper was again applied and weight bearing was guarded, including removal from school. He was given calcium salts and small doses of thyroid extract. A series of roentgenograms made of this boy showed no further bending of the neck, but did show a mottling and softening with fragmentation of the head, gradual disappearance of the outline of the head and its flattening out, with new bone formation at the neck.

In November, 1927 this process seemed still to be going on. The boy had grown an additional 6 inches in height and had a good weight; he was in perfect general condition. There was $\frac{3}{4}$-inch shortening of the right leg, an amount which had not changed since October, 1926, although he had not worn a caliper for six months. The right hip-joint permitted no abduction, about 40 degrees of flexion, and little adduction; there was no pain and he did not wear a caliper. The roentgenogram gave a picture indistinguishable from Legg-Perthes' disease.

DISCUSSION

The following definition has been offered by the writer in discussing these infections clinically:

"Acute epiphysitis at the capital end of the femur implies acute inflammation, a phlogistic process in adolescents caused by a pyogenic infection of the proximal (capital) epiphyseal area of the femur, possibly starting in older children on the diaphyseal side. The process usually results in fever, raised leukocyte count, constitutional evidences of sepsis or pyemia, the formation of pus, rapid invasion of the hip-joint, a tendency to metastatic multiple abscesses not necessarily limited to bones and joints, a difficult clinical recognition, and a high mortality."

Clinical experience recorded in these cases shows that an early recognition of this condition is both life and tissue saving. Disability in the limb and prolonged or fatal illness may be avoided if this disease is better understood.

The **pathology of acute epiphysitis of the femur** involves

primarily the blood-supply of the epiphyses. Poland said that the epiphyses obtain blood-supply from the network of periosteal arteries, branches of which perforate the compact bone to be distributed throughout the cancellous bone independent of the diaphyseal blood-supply. Consequently, after epiphyseolysis one would not expect the head of the femur to become necrotic, as it is supplied mainly by the epiphyseal vessels independent of the diaphyseal blood-supply.

The blood-supply of the epiphysis of the femur has recently been investigated by Kolodny. Four sets of blood-vessels are quite constant in the head and neck of the femur of newborn and children.

1. Vessels from the diaphysis of the femur extending into the neck and head.
2. Epiphyseal blood-vessels proper.
3. Blood-vessels arriving via the ligamentum teres.
4. Periosteal blood-vessels.

1. Come from the superior nutrient artery of the femur and may cross the epiphysis to enter the head.

2. Enter the head along the edge of the articular surface, one group from above, one group at the insertion of the joint capsule on the inferior aspect of the neck.

3. Ligamentum teres vessels, usually two in number, truly epiphyseal in character, come from the obturator artery.

4. From the periosteum of the neck penetrate many important vessels which are both intra- and extracapsular.

The **bacteriology of acute epiphysitis** has been investigated in the patients on whom operation has been performed. The organisms involved in acute epiphysitis of the upper end of the femur are those found in osteomyelitis of adolescents—principally staphylococcus and streptococcus, rarely other forms. Tonsillar and nasal infections, pneumonia, skin lesions, acute infectious diseases, and other foci in the body are the source of bacterial supply.

Localization of the infection in the upper epiphysis of the femur is aided by the rich blood-supply and probably by trauma as in ordinary hematogenous infection of bone in childhood.

Course of Epiphysitis.—One cannot say just how the infection arrives in the epiphyseal area in any given case. The inflammation once started rapidly involves the epiphyseal area, spreads by pressure and continuity along the cartilage plate to involve much of the blood-supply by thrombosis or direct contamination.

Of anatomic necessity the hip-joint must early be included in the involved area. Thrombosis aided by the trauma of weight bearing even in the presence of pain and direct extension leads to coxitis. This process is probably very rapid, taking place in a few hours. The hip-joint becomes distended, the limb seeks a position of flexion and internal rotation, immobilized by its own muscles to guard against pain. Limited necrosis of the cartilage plate, bursting of the hip-joint capsule, and dissemination of the pus into the surrounding tissues follow. The cartilage of the head of the femur or sometimes the acetabulum becomes necrotic and dies. The infection may spread down the diaphysis of the femur or into the pelvic bones, or subside.

Epiphyseolysis or separation of the head of the femur from the diaphysis, may occur at this stage, and the femur separates at the epiphyseal plane either slowly or rapidly, depending on whether trauma or weight bearing is a factor. Should the disease be arrested at this stage, I believe it may clinically and pathologically be confused with Legg-Perthes' disease or osteochondritis juvenilis of the hip-joint, because the presence of pus is not recognized and no clinical evidence of it is ever seen. The capital epiphysis of the femur, however, loses its normal shape, fragments, flattens, and permanent changes in the shape of the neck of the femur remain. These changes result in a mushrooming outline of the head with restriction of joint motion in many instances.

The pathology of the complications of epiphysitis of the femur continues to develop at a much slower rate than the pathology of the acute onset. The head of the femur may become a sequestrum retaining its original density, to appear with a relatively deeper shadow when compared to the surrounding bone which undergoes calcium loss from disuse. Granulations and

bone absorption appear in the epiphyseal area, causing both dark and light shadow areas in the roentgenogram. Bone softening progresses a varying extent down the femoral neck. The hip-joint capsule after bursting retracts and pus burrows along the psoas muscle or posteriorly along the neck of the femur, limited by muscles and fascial layers. The distended hip-joint loses its synovial surface from inflammation and laxity of the capsular covering of the joint follows. Pathologic dislocation of the hip may then result, caused by gravity as the patient lies in bed, flexion of the limb, and spasm of the flexor and adductor muscles. New bone formation begins from the diaphysis or the eroded surface of the acetabulum or pelvis. Pyemia develops or is a part of the original infection. Secondary abscesses, septic pneumonia, and endocarditis complicate the situation. Sinuses may open spontaneously around the hip; urinary obstruction from pressure on the urethra may be found; cystitis, decubitus ulcers, and other points of osteomyelitis in the sacrum and ilium follow from prolonged bed pressure and lack of nursing cleanliness. The patient may thus end in misery, bedridden, with infected urinary tract and loss of superficial tissues on the back.

Observation shows that the head of the femur usually follows the neck into pathologic dislocation, even though separated by epiphyseolysis.

Should the patient survive the acute and subacute stages, avoiding decubitus and urinary tract complications, he may again become ambulatory, usually with adducted leg, sinuses from bursted abscesses or operative drainage about the hip, sequestrated femoral head, considerable loss of range of motion in the hip-joint or pathologic dislocation, and the formation of an adventitious acetabulum at the point of pressure from weight bearing. The original acetabulum fills in with granulation or fibrous tissue which may later become bony. The femur may become bonily fused with the ilium at its new situation; it may become ankylosed at the site of the original hip-joint or some restricted range of motion may endure after the process has quieted down.

In a general surgical practice, a wide range of differential diagnosis of this acute epiphysitis in its various stages, the following represent my experience over several years of contact:

1. Acute osteomyelitis of the ilium which may closely simulate epiphysitis or extend into the hip-joint.
2. Acute appendicitis.
3. Cystitis and pyelitis or acute septic kidney.
4. Fracture of the neck of the femur in adolescents—not through epiphysis.
5. Tuberculosis of the hip-joint.
6. Osteomyelitis of the upper end of the femur (diaphysis).
7. Acute primary suppurative coxitis—probably very rare.
8. Acute psoas abscess, usually metastatic.
9. Traumatic separation of the upper epiphysis of the femur.
10. Dislocation of the hip.
11. Osteochondritis deformans juvenilis coxæ, Legg-Perthes' disease.

A direct diagnosis in the early stage is made by the history of an acute onset, fever, leukocytosis, and pain referred to the hip and thigh. Depending on the age and intelligence of the child, one may be able to localize the exact site of pain and tenderness. The one outstanding feature is pain or fear of pain when the affected femur is moved actively or passively. A point of tenderness may be found anteriorly over the neck of the femur, but frequently the pain is felt all about the hip region or even in the right lower quadrant of the abdomen. Diagnostic thumping or pressure of the greater trochanter of the femur is not always enlightening.

Roentgenogram is of no help when the diagnosis is imperative, namely, at the onset. After seven to twelve days changes may appear in the head and neck of the femur and roentgenologic epiphyseolysis may start. The head of the femur retains an original density as compared to a rapid atrophy of disuse with calcium loss in the adjacent bones.

The head of the femur does not tend to fragment very much, but appears to die en masse and remain as a sequestrum. The normal trabeculation in the upper part of the diaphysis of

the femur becomes indistinct and mottling appears in the bone. If the patient is operated upon at this stage, the head of the femur is found partly dead in a joint which usually has ruptured. The head is surrounded by recently formed granulation tissue with bone absorption in both head and diaphysis. Distinct pus may be wanting in mild cases; it is always present in fulminating cases. Along with these findings go great prostration, dehydration, and intoxication; the patient is very ill with bacteremia.

If we acknowledge that the severity of all acute infections varies, acute epiphysitis of the upper end of the femur is probably no exception. The symptoms given here are characteristic of a fulminating, dangerous infection. By analogy with osteomyelitis in other parts of the body one may conceive of a condition in which this infection is not so overwhelming. The process may not only be milder, the organism less virulent, the patient's resistance greater, and the pathology less extensive, but also tissue destruction and end-result may be slower and less wide-spread.

May one not believe, therefore, that in the very mild forms epiphyseolysis may follow weight bearing or a sudden trauma from jumping or falls on a femur, the seat of this less severe type of infection, when the process has been going on subacutely for some time and no clinical recognition has been given it? Pathologic dislocation is far less liable to follow the mild case because there is much less muscle spasm.

In reviewing the case records one finds in Case IX that although the onset was acute, rest in bed ultimately effected a symptomatic cure, yet bone changes almost identical with Legg-Perthes' disease went on for months. In Case X acute symptoms occurred at a very young age—six months. This later gave no likeness of tuberculosis or of typical Legg-Perthes' disease. Cases XI and XII seem to me to be indistinguishable from Legg-Perthes' disease in their end-stages, as might also Case III. Fortunately the whole course of the disease was under the observation of one surgeon. The end-results of the cases with free suppuration and operative drainage differ little roent-

genologically from those not operated upon and may finally pass for Legg-Perthes' disease.

In a discussion of the clinical importance of necrosis and changes in structure of the head of the femur after separation of the epiphysis from trauma or luxation, Müller[1] concluded after extensive research on dogs, cats, guinea-pigs, and rabbits that a healthy femur may develop a typical picture of juvenile deforming osteochondritis at the hip-joint after epiphyseal separation on account of local circulatory disturbances, especially when involved in fracture, the picture being one of a sequence of pathologic processes and not a definite clinical entity. However, he considered that the secondary bone changes still await explanation. Other writers are inclined to favor an infectious cause of Legg-Perthes' disease.[2]

The end-results after two or three years roentgenologically studied fail to show any difference between drained and healed acute epiphysitis and Legg-Perthes' disease.

The **treatment of acute epiphysitis of the capital end of the femur** presents difficulties and invites boldness of attack. The first and most important step is to make the diagnosis. This must follow after getting the history of onset, fever, tenderness about the hip, immobility and flexion of the hip, leukocytosis, and a negative roentgenogram. The film made early in the course of the disease may show a slight widening of the hip-joint, rarely any blurring. Tenderness in the hip-joint of a child is difficult to demonstrate.

Diagnostic puncture, followed by aspiration of the hip-joint, may be misleading. One has difficulty entering the joint and many punctures are consequently dry. If the joint is entered, a thin seropus containing leukocytes and organisms may be obtained.

After the diagnosis has been made the hip-joint should be opened surgically to relieve the pressure of pus within it and to give drainage. In the early case the slightly distended joint yields a thin, blood-watery pus, not yellow, not thick.

[1] Beitr. z. Klin. Chir., 132, 490–522, 1924.

[2] Balensweig, Surg., Gyn., and Obst., xliii, 604, November, 1926.

Operation to Drain the Hip-joint in Acute Epiphysitis.—The hip-joint may be easily and quickly opened by an anterior approach in Scarpa's triangle, avoiding the femoral vessels by keeping lateral to them. Fluid found in the joint is cultured and smeared. The capsule is incised widely enough, sometimes by crucial incision, to permit free exit of all joint exudate and a small rubber tube drain is inserted *down to the joint—not into it.* One may irrigate this wound and joint with Dakin's solution if it is thought desirable.

In fulminating cases early recognition is the important factor. Early drainage may save metastases or an overpowering septicemia. It prevents bone destruction and may obviate pathologic dislocation. Blood transfusion is indicated.

Postoperative Treatment.—After opening the hip, leave free drainage; encourage the patient to move the joint. One usually finds that the skin and soft parts of the wound wish to close long before the joint may be completely drained—secondary gathering of pus with recurrence of symptoms follows.

Procedure After Delayed Diagnosis.—If the patient is seen after the disease has been in progress and pus has spread into the tissues about the hip, the difficulties of diagnosis in the operation may be increased. Do not be satisfied with the finding of pus in the upper thigh or in the hip region—*find where the pus originates.* If possible, osteomyelitis of the diaphysis or ilium should be ruled out before opening the hip-joint. The hip-joint is opened and drained as in the early cases. On account of the burrowing of pus it may be necessary to make a counter-opening posteriorly along the neck of the femur and behind the greater trochanter. By this means through-and-through drainage or irrigation may be instituted. No attempt is made to remove any bone until sequestration is definitely shown by the roentgenogram.

Immobilization to Avoid Contractures About the Hip and Dislocation.—If pus has invaded the periarticular structures the whole leg should be immobilized in a body plaster encasement, the leg in full extension, and 30 degrees abduction. A window cut in the plaster facilitates dressing.

Type of Dressing After Epiphyseolysis or Dislocation.—If the epiphysis has become separated, with leg shortening and adduction, immobilize in plaster-of-Paris body encasement after drainage of the hip-joint followed by traction, inversion of the foot, and maximal abduction.

When the hip-joint has been dislocated recently in the pathologic process, drain, put the leg in extension traction and abduction after a reduction has been made.

Operative Procedure for Old Cases.—Hip-joints long dislocated, after epiphysitis, with an adventitious acetabulum or extensive pressure sores cannot often be reduced. They must be drained, all sequestrated bone and granulations removed, the ilium freshened, and the leg put in slight inversion with about 30 degrees abduction, to be held by plaster of Paris for a varying period of time. If ankylosis follows, a supporting metal brace is used until uncontrolled weight bearing is possible.

When the pathologic dislocation of the hip is old, with ankylosis and the leg is shortened and adducted, a subtrochanteric osteotomy and leg abduction are indicated. It is needless to add that sunlight and hygienic measures are required to restore the patient to health.

CLINIC OF DR. PHILIP H. KREUSCHER

MERCY HOSPITAL

INCISIONS FOR APPROACH TO MAJOR JOINTS

THE incision for the approach to the major joints has not been sufficiently emphasized. In order to make a full exposure of the joint a sufficient amount of the skin must be retracted without excessive tension to enable the operator to reach into any portion of the joint cavity. The type of incision one chooses to employ must depend upon:

1. What operative procedure is to be undertaken.
2. The position of the extremity.
3. The condition of skin and subcutaneous tissues about the joint.
4. The portion of the joint to be exposed.

In the knee-joint, for instance, where a minor arthrotomy for the removal of a foreign body or for the removal of a semilunar cartilage is to be undertaken, the incision will be small and over that area of the joint where entrance is to be made. If, however, one expects to expose the entire knee-joint, dividing the patellar tendon and fibrous capsule, a very definitely outlined and planned incision is necessary. In the hip-joint where one wishes to expose the entire neck, head, and acetabulum, a small incision is obviously of no value whatever. The incision must be sufficiently long and must expose completely the deeper tissues to be divided and the deeper structures to be exposed. Many years ago Lane made the statement that a long incision heals just as quickly as a short one, and he taught us at that time the value of an extensive exposure over that portion of the anatomy upon which the operation is to be done. The shorter incision necessitates extreme traction, gives inefficient exposure of the deeper structures, and certainly insufficient exposure of the bony parts to be attacked.

The essentials of an efficient approach incision may be well enumerated as follows:

1. It must make the necessary exposure without undue tension on the skin and upon the muscles that are split or divided.

2. It must as much as possible lie in straight or gracefully curved lines. A right angle incision is not indicated at any time as we see it now. A transverse incision unless made along the line of a previous incision is not permissible. Even in the presence of a previous incision, I believe it would be advisable to make the longitudinal cut through the skin in most instances.

3. A uniformity of incisions for the various joints should be aimed at as much as possible.

4. It should lie in the same line with the underlying structures to be divided.

5. In order to avoid subcutaneous adhesions it should not overlie superficial bony prominences.

6. The flap must have a sufficient amount of subcutaneous fat to insure subsequent sliding action and blood-supply.

7. It should not divide nerves or blood-vessels which are subsequently necessary for the life of the flap, nor should one at any time overlook the direction of source of blood and nerve supply of the skin.

For the exposure of the shoulder-joint and the upper end of the humerus, the incisions of Ollier, Langenbeck, and Senn have been used. A number of years ago I began using a curved incision, beginning just anterior to the acromion process, passing downward and slightly forward, ending at its lower end about the insertion of the deltoid. This long incision gives one an exposure of the acromion process, the tuberosity of the humerus, the upper end of the shaft of the humerus, as well as the glenoid cavity (Fig. 175). This incision follows almost directly along the line of fibers of the deltoid muscle. The muscle-fibers may be split, not cut transversely, until the long and short head of the biceps are exposed; these being retracted the upper end of the humerus comes definitely into the field. The exposure of the structures in this way does not in the least impinge upon nor does it easily permit of trauma of the axillary nerves and vessels.

The blood-supply of the structures through which the surgeon has passed are not in any way seriously embarrassed.

In the elbow-joint exposure the lateral incisions, the U-shaped and the inverted U, have been utilized. The objections to these incisions are obvious. When one wishes to perform an operation upon the elbow-joint, such as an extensive arthrotomy, arthroplasty, or reduction of fractures in and about the elbow-joint, several very important structures must be taken into

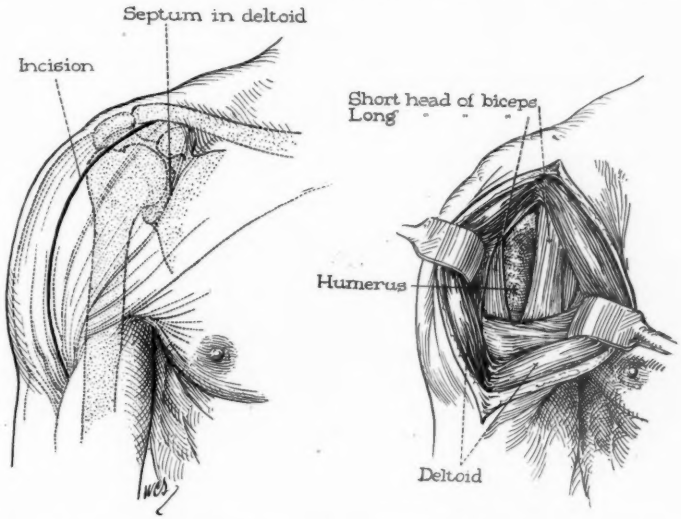

Fig. 175.—Approach incision to the shoulder-joint for extensive operations upon the upper end of the humerus and glenoid cavity.

consideration. First, the musculospiral and second, the ulnar nerve, as shown in Fig. 176. An exposure from the posterior aspect of the joint has many definite advantages. The lower end of the humerus can be visualized as well as the olecranon process and the upper end of the ulna. The incision which I have used for a number of years begins about $2\frac{1}{2}$ inches above the tip of the olecranon process, extends downward and backward until it passes the tip of the olecranon, then extends forward and downward. The exposure of the internal condyle through this

incision makes it possible to visualize at once the ulnar nerve in its sheath as it passes behind the condyle. The sheath may easily be incised and the nerve drawn out of the field of operation. The joint may then be approached either by dividing the triceps tendon or by doing a subperiosteal elevation over the tip of the olecranon process. In this way the tendon may be pushed aside out of the field and one is at once in the joint.

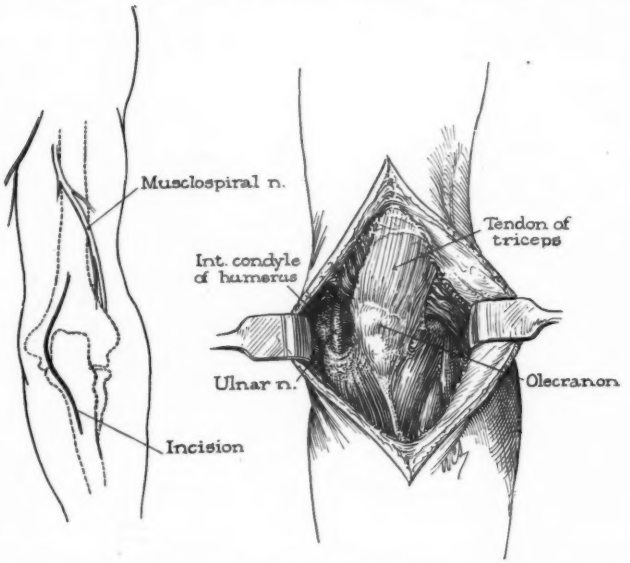

Fig. 176.—Incision exposing the posterior aspect of the elbow-joint, showing position of the musculospiral and ulnar nerve. This incision is especially adapted for arthroplasty of the elbow, reposition of fractures of the lower end of the humerus, and the olecranon process.

With very little exposure the head of the radius may also be exposed if that is desirable. By a careful freeing of the tissues in front of the humerus the vessels and nerves occupying the anterior space may easily be drawn out of position with a retractor or curved periosteotome. Through this incision one has then been enabled to perform any type of operation upon the elbow-joint without in any way seriously hazarding the ulnar

nerve, the musculospiral nerve, or the vessels and nerves in front of the elbow-joint. Necrosis of skin should not occur unless undue tension has been put upon the skin flaps or unless an insufficient amount of fat has not been permitted to remain on the skin. Sensory disturbance of the skin has been avoided entirely. There should be no danger of adhesion of the skin to the subcutaneous tissues and periosteum.

In the exposure of the hip-joint the incisions of Smith-Petersen, Kocher, Murphy, Lagenbeck and Ollier have all been utilized. The U-shaped incision of Murphy or the modified

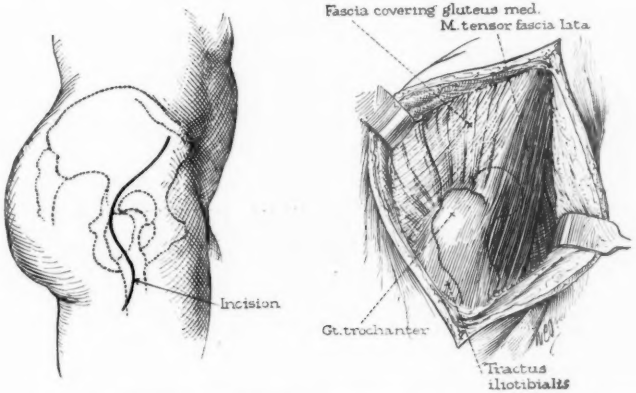

Fig. 177.—Author's incision for exposure of the greater trochanter, neck and head of the femur, and acetabulum utilized in operations upon fractures of the neck of the femur and arthroplasty of the hip.

goblet incision of Murphy-Ollier makes a splendid exposure of the greater trochanter, but has certain very definite disadvantages. First, it divides cutaneous vessels and nerves almost transversely and the posterior portion of the U is carried so far back upon the buttocks that postoperative infections are apt to occur. I have seen infections in this portion of the incision many times where otherwise the rest of the incision was entirely clean. I have seen in many instances necrosis of the skin at the tip of the U. The Smith-Petersen incision has a very decided advantage when one wishes to expose only the acetabulum or

head of the femur. It is inefficient, however, in such cases where we wish to expose the neck of the femur and where a new head and acetabulum is to be made.

The incision which we have used for the past ten years (Fig. 177) begins 1½ inches behind the anterior superior spine of the crest of the ilium and curves downward and backward until the posterior portion of the greater trochanter is reached, from where it again curves gently forward to the midline of the femur about 2 inches below the top of the greater trochanter and from there curves downward and backward. It is surprising how much exposure can be produced through this incision without undue tension upon the skin flaps. The lower part of the incision which at first would seem unnecessary gives one a very considerable exposure of the greater trochanter and the upper end of the femur which otherwise would be impossible to obtain. The greater trochanter, the upper 3 inches of the shaft of the femur, the fascia covering the gluteus medius, and the tensor fascia lata immediately come into view when the skin flaps have been resected as indicated in Fig. 177. With or without removal of the greater trochanter the fascia may be incised along the line of direction of the neck of the femur and immediately one comes down upon the head without a transverse incision of the muscle-fibers. If desired the greater trochanter with its muscular attachment may be very conveniently sawed or chiseled away and retracted out of the field. A subperiosteal resection of the greater trochanter from before backward can easily be accomplished, as can a subperiosteal resection of the tissues attached to the anterior portion of the trochanter and neck. With the least trauma to the gluteus medius and to the tensor fascia lata, which are retracted by large curve retractors or periosteotomes, the head and acetabulum are exposed. The entire incision has been kept away from the gluteal region and from the gluteal fold, where infection from excreta so easily occurs.

The approach incision for arthrotomy or arthroplasty of the knee-joint is one which we saw in London a number of years ago (Fig. 178). The U-shaped incision of Murphy was discarded

by him because it divided the skin and its vessels and nerves transversely, because of the frequent necrosis of the tip of the flap, and because of the frequent adhesion of the skin along the course of the incision where it passed along the lower end of the patella or patellar tendon. The inverted U incision of Putti has some of the same objections. The lateral incisions do not sufficiently expose the knee-joint as has been proved in many instances.

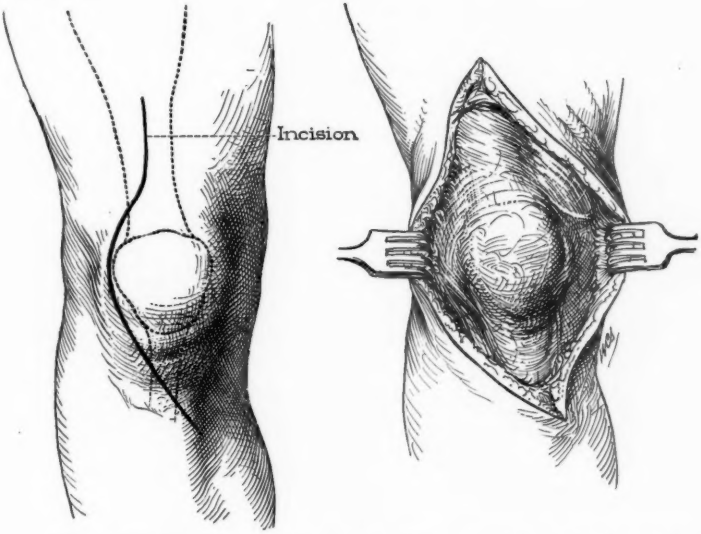

Fig. 178.—Approach incision to the anterior portion of the knee-joint for extensive arthrotomies, operations upon the patella, and arthroplasty of the knee.

The most useful incision is the one alluded to above and is one which we saw used by Trethowan. It begins in the midline of the thigh about 3 inches above the upper aspect of the patellar, passes downward, slightly outward, avoiding the patella entirely, then proceeds downward crossing the tibia below the tubercle, and extends to the inner side of the tibial aspect about 3 inches below the lower tip of the patella. I very much prefer the curve of this incision to the outer side of the patella because

the greatest blood-supply coming from within assures the viability of the longer flap. The undermining of the skin leaving as much subcutaneous fat as possible attached to it gives one a splendid exposure of the anterior portion of the knee-joint. It enables one to make the split patella operation, the Z division of the patellar tendon or quadriceps extensor tendon, with equal ease. An extensive arthrotomy or arthroplastic operation may be made through this incision without the slightest danger of embarrassing the circulation of either flap. The incision does not overlie the patella nor the patellar tendon, nor does the skin become adherent to any structure which would in any way limit the motion of the joint.

CLINIC OF DR. DANIEL N. EISENDRATH

MICHAEL REESE HOSPITAL

THE CAUSES OF FAILURE AFTER BLADDER NECK OPERATIONS

EVERY urologist who has performed a large number of operations for bladder neck obstruction from time to time finds that a certain number are either complete or partial failures. We prefer at the present time to employ the term "bladder neck obstruction" rather than hypertrophy of the prostate, because

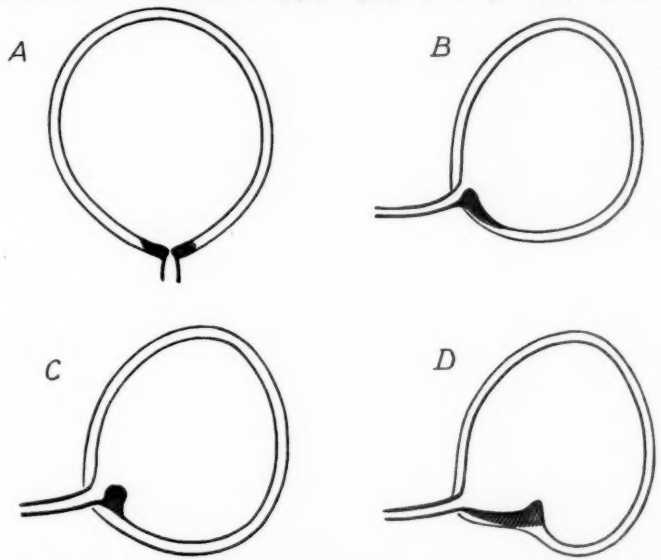

Fig. 179.—Diagrammatic representation of various forms of bladder neck obstruction. *A*, Contracture of bladder neck which may also involve prostatic urethra. *B*, Median bar formation. *C*, Prostatic hypertrophy. Only a median lobe obstruction is shown. This may exist alone or in association with hypertrophy of the lateral lobes. *D*, Hypertrophy of trigone and interureteric ridge with marked retrotrigonal pouch.

experience has shown that there are other anatomic conditions (Fig. 179) than prostatic enlargement which can give rise to exactly the same clinical pictures and sequelæ.

If one takes it for granted that every male after middle life giving the history of frequency of urination, dysuria, and evidences of retention is suffering from prostatic hypertrophy, the number of failures after operative interference will be even greater than it is. Prostatic hypertrophy will account for the majority of bladder neck obstructions, but by no means all of them.

The following must be kept in mind as causes of frequency, dysuria, and chronic retention after middle life:

1. Urethral sources:
   (*a*) Stricture of the urethra.
   (*b*) Calculi.
   (*c*) Tumors.
2. Prostatic sources:
   (*a*) Calculi compressing urethra.
   (*b*) Prostatic hypertrophy.[1]
   (*c*) Carcinoma and sarcoma of the prostate.
   (*d*) Acute and chronic prostatitis.
3. Changes at or close to the vesical neck:
   (*a*) Contracture of and around the vesical outlet as the result of increase of fibrous tissue. The process may also involve the prostatic urethra (Buerger).
   (*b*) Median bar formation.
4. Vesical sources:
   (*a*) Tumors arising from the bladder wall or invading it secondarily.
   (*b*) Calculi impacted in the vesical outlet.
   (*c*) Large vesical diverticula. Some of these may, especially if subtrigonal, occlude the outlet.
   (*d*) Hypertrophy of the trigone or of the interureteric ligament or of both.
   (*e*) Neurogenic conditions of central origin, *e. g.*, tabes, cerebrospinal syphilis, etc.
   (*f*) Atony of the detrusor muscle which is incident to old age, *i. e.*, senile atony.

I have enumerated these because it is essential to exclude one after the other if one wishes to reduce to a minimum the percentage of failures after operative interference, no matter

[1] Although we know that the growth is the result of a hyperplasia of the prostatic glands and termed by Ribbert an "adenoma," the older term is still retained.

whether the latter simply consists of a cautery punch operation or a more complicated procedure, such as operations (suprapubic) for bladder neck contracture or prostatectomy.

After a careful study of the experience of others, added to our own, as to the reasons for some of our failures after bladder neck obstruction, the following grouping seems to be a good one to bear in mind when cases present complaining of symptoms some months to years after operation.

1. Urethral sources. An overlooked urethral stricture.

2. Sources referable to the prostatic bed.[1]

(*a*) Infection of the prostatic bed causing persistent pyuria and often accompanied, if the infection is due to organisms like the proteus ammoniæ, by calcareous incrustations on the walls of the cavity from which the prostate has been removed. We saw such a case three years after a suprapubic prostatectomy by an excellent operator. The principal symptoms were severe pain on urination, frequency, and hematuria. The walls were "plastered," so to speak, with incrustations of calcium phosphate.

(*b*) Incontinence of urine. This has been considered to occur more frequently after perineal than suprapubic prostatectomy. A sufficiently large number, however, follow the latter route to cause one to hesitate in stating that it is extremely rare. We have encountered such incontinence, fortunately of minor degrees, in cases in which there was a small firm fibrous, as well as in an occasional case in which there was a large prostate with marked intravesical protrusion. Fortunately, the percentage of this unwelcome sequel is minimal. Why it should occur after a suprapubic operation is not clear. We know that there are two sphincters, one the internal, which, as Wesson has so clearly demonstrated, surrounds the vesical outlet in an imperfect manner and whose fibers are continued so as to enclose the prostatic urethra. If one has ever examined digitally an internal urethral orifice a year or more after a suprapubic[2] operation, it does not

[1] By this is meant all causes of postoperative symptoms or findings which follow removal of the prostate, whether by the perineal or suprapubic route.

[2] My experience is practically limited to removal of prostatic hypertrophy by the suprapubic route.

require much of a stretch of the imagination to note that the function of the internal sphincter is practically eliminated. The chief mode of control of the act of urination after operation both by the suprapubic as well as by the perineal route is a perfectly functionating external sphincter (Fig. 180). This envelops the membranous urethra and its function after prostatectomy as the only sphincter has been shown by the work of A. Hyman.

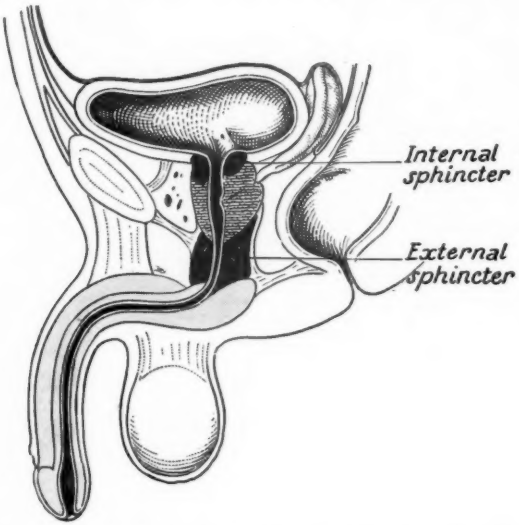

Fig. 180.—Diagrammatic representation of locations of internal and external sphincters. Note how latter surrounds membranous urethra. This must be kept in mind in perineal prostatectomy.

One needs only to make a postoperative cystogram to be convinced.

The bugbear of perineal prostatectomy for a long time was such an incontinence but, fortunately, with the modification by Young and his co-workers, this is no longer dreaded as it was.

(*c*) Strictures at the anterior or posterior ends of the prostatic bed. Our attention was first directed to this anatomic condition by Thomson-Walker as the chief factor in giving rise to late symptoms such as frequency, dysuria, and even retention,

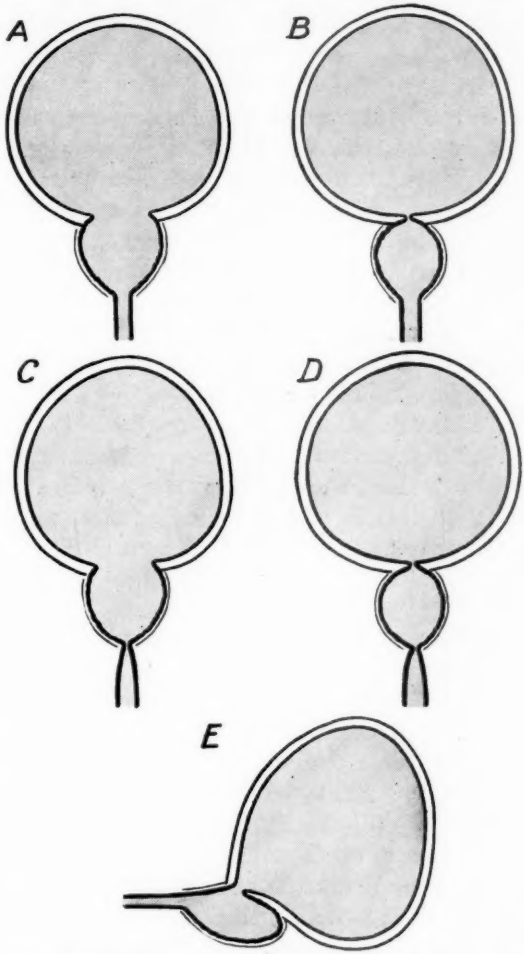

Fig. 181.—Diagrammatic representation of some of the more common sequelæ at the bladder neck and in the prostatic urethra. *A*, Hour-glass formation. Almost unavoidable after either suprapubic or perineal prostatectomy (see text). *B*, Stricture at junction of prostatic bed and bladder neck. *C*, Stricture of urethra at anterior extremity of prostatic bed. *D*, Strictures at anterior and posterior extremities of prostatic bed. *E*, So-called shelf formation. A flap of the bladder floor forms a roof to a cavity which remains after enucleation of the prostate (see text).

accompanied, of course, by evidences of infection. He also was the first to point out the so-called canopy or shelf formation which we will take up later.

A glance at Fig. 181, where a diagrammatic reproduction of some of these postoperative findings has been attempted, will assist in visualizing the conditions as one finds them months to years after operation. In *A* of this figure the "hour-glass" condition as described by Hyman is shown. This is a very common postoperative finding, consisting of a moderate fibrous narrowing of the vesical outlet which remains patent sufficiently to allow the bladder to empty its contents so that there is no residual and the urine remains clear after a satisfactory operation. The bladder lumen forms the proximal end, and the prostatic bed the distal end of the hour-glass. The narrowing between the two is the vesical outlet.

In *B* of this same figure is shown a marked narrowing or stricture formation at the vesical outlet, *i. e.*, at the posterior end of the prostatic bed. Such a stricture is not infrequently associated, as in the case which will be presented today with a canopy or shelf formation (see *C*).

In *C* of this same figure is shown a similar stricture at the anterior end of the prostatic bed with resultant marked dilatation of the latter, as well as abnormal width of the vesical orifice. The effects of back pressure on the bladder and upper urinary tract are just the same as if a neck obstruction had never been operated. We have recently encountered such a case two years after prostatectomy (suprapubic).

In *D* of the series of diagrams we have attempted to show a stricture at both the anterior and posterior ends of the prostatic bed. We have never seen this clinically, but can readily understand that it might occur.

Thomson Walker has proposed excision of the strictures at the vesical outlet (*B* of Fig. 181) through a suprapubic incision, but, as in the case of urethral strictures of either gonorrheal or traumatic origin, we fail to see how the enlarged lumen of the new opening can be permanently maintained without systematic postoperative passage of bougies or sounds. This means that

there is hanging over the patient like a sword of Damocles the threat of an epididymitis if a seminal vesiculitis coexists (see below) unless prophylactic vas ligation has been done.

We are of the opinion that sounds or at least bougies (up to size 25 F.) should be passed at regular intervals for at least a year after any procedure for the relief of a bladder neck obstruction. Only too often is the patient dismissed without being enjoined to report frequently in order to avoid such postoperative complications as the types of stricture formation which we have spoken of.

Since we have routinely performed division of the vas deferens and at the same time injected 10 per cent. argyrol into the seminal vesicles through the proximal end of the vas (before ligation), and followed this postoperatively by passage of sounds (or bougies), not only has the urine remained clear, but there has been no residual, and the vesical neck will easily admit a 30 F. sound, which is as large a caliber as one needs to use.

(*d*) Canopy or shelf formation. Not infrequently a cavity remains after prostatectomy, especially suprapubic, which is continuous with the prostatic bed as shown in *E* of Fig. 181. Its floor and lateral walls are formed by the posterolateral portions of the true or surgical capsule of the prostate which remains after removal of the hypertrophied lobes. The roof is formed by a flap of mucous membrane and fibrous tissue, both of which are continuous with the vesical trigone. This roof probably corresponds to that portion of the mucosa which originally covered the intravesical portion of the prostate and remained after the enucleation of the latter. One can often avoid such a complication by palpating at operation the bed from which the prostate has been enucleated. If a long protruding shelf separates the floor of the bladder from the prostatic bed, it can more easily be excised in a one-step than in the two-step operation. Thomson Walker has suggested making a wedge-shaped suprapubic excision of such a canopy or roof if there is retention of infected urine in such a pocket.

(*e*) Recurrences after prostatectomy. There can no longer be a question that nodules of hyperplastic glandular character

can develop in the true or surgical capsule. The work of Jacoby has greatly clarified our views as to how the peripheral glands of the normal adult prostate are displaced centrifugally by hyperplasia, or, as Ribbert terms it, true adenoma formation in the urethral prostatic glands which lie in the submucous portion of the prostatic urethra. One can readily understand how new nodules may develop in this compressed peripheral portion of the prostate which forms its "surgical" capsule. A reformation of prostatic nodules may attain such dimensions as to give rise to symptoms many years after operation. This is not the only source of recurrence. In some cases the enucleated prostate can be observed to have projecting from its surface pinhead size to larger nodules of hyperplastic glandular tissue. It is not difficult to understand how some of these can be overlooked and later develop into nodules sufficiently large to serve as sources of obstruction.

(*f*) Overlooked carcinomas of the prostate. In hospitals where every prostatic hypertrophy or similar bladder neck (median bar, etc.) obstruction specimen is studied microscopically, it is not unusual to receive a report from the pathologist that a given prostate, etc., showed evidences of malignant changes. Such a report was not expected, judging by the gross appearance of the specimen at operation. This class of cases, strictly speaking, cannot be assigned a place in the group of failures, but it will explain many a case in which no microscopic examination was made, but the symptoms continue.

3. Vesical sources of failures. Only the more important ones will be mentioned:

(*a*) Large diverticula which were overlooked because the patient's condition did not permit either a cystoscopy or a cystography to be made or they were not considered essential. We will not attempt to digress and consider the diagnosis of the size, location, etc., of such diverticula because this, in our opinion, should be a portion of the routine study of every case of bladder neck obstruction if conditions permit.

Suffice it to say that diverticula of moderate or large size (whether they contain calculi or not) are, we believe, one of the

most common causes of the persistence of a pyuria, frequency, dysuria, etc., after bladder neck operations. It is generally conceded that the majority of the larger or true diverticula are of congenital origin, but develop rapidly in size if there is any obstruction to the escape of urine from the bladder or urethra. Smaller, more shallow false diverticula or cellules may also be the seat not only of calculi which are overlooked unless preoperative cystoscopy is done, but these shallow pockets which are found between the trabeculæ, may favor infection for a long period after operation.

(*b*) Persistence of cystitis. This is a frequent source of failure and may be due to a seminal vesiculitis, to renal infection, and to a failure to relieve the obstruction or formation of strictures, etc.

(*c*) Errors in the diagnosis of the cause of the obstructive symptoms. In this group of vesical sources of failure are to be included cases in which a diagnosis was made of the bladder neck obstruction being due to a contracture of the vesical outlet or a median bar, when, in reality, there was an underlying hypertrophy of the prostate of the subvesical or intravesical types as described by Tandler and Zuckerkandl in their classical monograph on the subject. In such cases a cautery punch or similar operation will only give temporary relief. Under mistakes in diagnosis must also be included cases in which the dysuria and retention are not so much due to an obstruction as to atony of the detrusor muscle. This latter condition may have been a local manifestation of tabes or some other form of spinal cord lesions. A form of atony known as senile, not of central origin, may be present, so that removal of the obstruction is followed by persistent inability to empty the bladder. One must always exclude tabes, etc., by the preoperative examination of the central nervous system. It has been shown that tabes and a mechanical bladder neck obstruction can coexist.

4. Renal sources. When symptoms such as pyuria, frequency, and recurrent attacks of chills and fever persist after removal of a bladder neck obstruction, and all of the sources just enumerated have been excluded, the existence of a pyeloneph-

ritis must be considered as the source or cause of the failure to obtain a satisfactory result. The renal infection may be due to calculi whose presence had not been suspected before operation because they belonged to the so-called "silent" group of renal or ureteral calculi. Radiography will rapidly eliminate calculi as a source of persistent pyuria. In some cases the condition known as reflux, *i. e.*, regurgitation of vesical contents into the ureters, may persist in spite of elimination of the obstruction, diverticula, etc. One should not hesitate to treat infected kidneys which give rise to symptoms after prostatectomy, etc., by in-lying ureteral catheter drainage or lavage of the renal pelvis just as one would a case in which no such bladder neck obstruction has existed.

5. Seminal vesiculitis and recurrent or persistent epididymitis. We have been able to practically eliminate these as late postoperative factors by obtaining the consent of the patient, at least in cases of prostatic hypertrophy, to immediate ligation and division of the vas on both sides and injection of the vesicles with some antiseptic solution (10 per cent. argyrol, etc.) through the proximal end of the vas before it is ligated. Few complications are more unwelcome than an epididymitis which occurs weeks to months after the operation or recurs from time to time either spontaneously or after the passage of sounds, etc.

It must be conceded that vasectomy will not act as a prophylactic against a hematogenous infection of the epididymis or be a failure if an epididymitis has already begun before the vas was ligated. Vasectomy will, however, in our opinion, reduce the percentage of cases, generally estimated at 20 per cent., of epididymitis to a negligible number if performed early enough.

Before discontinuing this "taking stock" of why we are not having 100 per cent. of perfect results after bladder neck obstruction treatment I will present a man of sixty whose secondary suprapubic incision has just closed. He was operated upon about a year ago at this hospital and a large hypertrophied prostate removed by the suprapubic route. He returned about six weeks ago complaining of frequency and of difficulty in voiding. The urine contained many pus-cells and had a slight

ammoniacal odor. Rectal palpation of the prostatic bed at the first examination failed to reveal any induration indicative of an overlooked carcinoma or reformation of a benign hypertrophy.

In attempting to introduce various types of catheters in order to determine whether there was any residual urine in the bladder one encountered a marked obstruction at a distance which corresponded to the bladder neck. We then decided to use a cysto-urethroscope in order to see the nature of the obstruction at the vesical outlet. To our surprise, the beak of the cystoscope could be felt just beneath the rectal mucosa when an effort was made with a finger in the rectum to assist the passage of the instrument through the vesical neck. We failed to understand such a finding until the secondary operation. In spite of every manual aid it was impossible to introduce the cystoscope through the vesical outlet. Unfortunately we did not make a urethrogram with 20 per cent. iodipin which would have cleared up the character of the anatomic condition in the prostatic bed and vesical neck. A secondary suprapubic exposure was decided upon, at which a very marked narrowing of a fibrous character which scarcely admitted a small sound was found at the vesical outlet. When this was enlarged by a wedge-shaped excision at the lower (posterior) edge, a cavity was found which corresponded to the bed from which the prostate had been removed. Its proximal third was not located in the urethra, but had burrowed its way beneath the vesical trigone. The roof of the subtrigonal portion was formed by the type of canopy or shelf (*E* of Fig. 181) to which Thomson Walker has directed attention. This was the space which our cystoscope had entered and was prevented by the roof of this cavity from entering the bladder. It was for this reason that the beak could be so distinctly felt through the anterior wall of the rectum. We extended our wedge-shaped excision of the lower edge of the strictured vesical outlet so as to include the roof of this cavity. A number of tags and nodules which protruded into the lumen of the prostatic bed were removed. Again, to our surprise, we found that the nodules appeared to be newly formed or possibly overlooked typical hyperplastic prostatic glandular tissue.

In a portion of the thick "surgical" capsule lining of this prostatic bed we also found a few similar nodules, all of which proved to be microscopically hyperplastic glandular tissue resembling in every respect those seen in hypertrophy of the prostate.

A bilateral vasectomy was performed before this secondary suprapubic exposure. The patient made an uneventful recovery, the urine is now clear, and the vesical neck admits easily a No. 30 F. sound.

This case illustrates some of the anatomic conditions which we enumerated at the beginning of this clinic. They are: (*a*) Stricture at the junction of the posterior end of the prostatic bed and vesical orifice; (*b*) canopy or shelf formation with extension of the prostatic bed posteriorly so as to be subtrigonal in part; and (*c*) reformation of hyperplastic nodules of prostatic glandular tissue in the "surgical" capsule as well as in the walls of the prostatic bed. The latter may possibly not be newly formed, but be the minute nodules which can be easily overlooked during enucleation of the prostate.

Some of the failures I have enumerated may be avoidable in the future since we are aware of their potential development. Some will always be unavoidable.

CLINIC OF DR. GOLDER L. McWHORTER

PRESBYTERIAN HOSPITAL

ENDS OF OMENTUM FUSED THROUGH OPENING IN MESENTERY PRODUCING ACUTE INTESTINAL OBSTRUCTION. CHRONIC SYMPTOMS SINCE CHILDHOOD. RESECTION OF OMENTUM, WITH RELIEF

ACUTE intestinal obstruction without previous operation or localizing symptoms is often a serious diagnostic problem. This patient is of unusual interest because of the presence of "indigestion" as long as he could remember, but with no acute symptoms until the present time, and the finding of a bifid omentum fused beneath the mesentery producing an acute constriction of the jejunum.

Mr. R. H. O., fifty-eight years of age.

Chief Complaints.—Pain in the abdomen for three days, vomiting, nausea, and constipation for two days. The onset began three days ago, about two hours after a bowel movement, with griping pains all over the abdomen. This progressed gradually and was associated with vomiting and nausea. The bowel movement was normal and there was no blood present.

The pain was intermittent, dull in character, lasting about half a minute, and then disappearing, leaving a soreness. The intervals between the attacks varied from a few minutes to one-half hour, or occasionally to two hours. Moving about seemed to make the pain worse. The pain did not radiate or move across the abdomen. It was located chiefly in the upper half of the abdomen. Vomiting occurred three times the day of onset, twice the second day, and once the day of entrance. The vomitus was largely mucus and yellowish until entrance, since when it has been black. He took three enemas on the first day and also a large dose of castor oil and citrate of magnesia, most

of which he vomited. There was no result from the cathartics and the enemas returned only slightly colored.

Past History.—There has been no serious illness and his health has been good. He had measles. There have been no surgical operations. He has had a double inguinal hernia for about twenty years. A truss has been worn for most of that time.

Family History.—Father and mother died at eighty-four and seventy-nine years; two sisters living and well; two sisters dead, cause unknown; two brothers died in infancy. Habits were good. Occupation was that of a piano tuner.

Gastro-intestinal.—Appetite has been good. No nausea or vomiting before this time. No history of any pains of this character. Since childhood he stated that he has had what he has termed indigestion and a weak stomach. He described this as a distress a few minutes after eating or during a large meal. He felt as though he were too full and would have to stop and wait a while. As the fulness decreased he would eat some more, but he was never able to eat a big meal without distress. He stated that the stomach would feel like a funnel with a constriction at the end where the food would stop in its passage. There would be a desire to push something down through his stomach which would last perhaps one hour. As a result he would resort to pushing his abdomen and slapping it with his hand. This condition has existed ever since he can remember. There was no food that caused especial distress, but he avoided bananas, cucumbers, and a number of other things which he thought would be hard to digest.

He usually had one or two bowel movements a day, well formed, without blood; no previous use of cathartics.

His usual weight has been 180 pounds and there has been no recent change.

Examination.—The patient was well nourished.

Abdomen.—There was some diffuse rigidity over the upper half of the abdomen. Tenderness was slight, but diffuse, and associated with moderate muscle spasm. There was only a moderate distention. No mass could be palpated. Liver and

spleen could not be palpated. There were two large inguinal hernias held back by a truss. Otherwise the examination was negative.

Laboratory.—Roentgenographic examination: Fluoroscopic examination of chest and diaphragm were negative. Fluoroscopic examination of the stomach showed the barium passing quickly into the stomach, which was high and somewhat transverse in position. The abdomen seemed slightly distended. Peristalsis was almost absent. At times there were very slight waves, but these never passed beyond the incisura. There was extreme tenderness over the region of the duodenal cap, which did not fill. Films showed the barium stopping abruptly at the end of the antrum, with a slight irregularity. No barium was seen beyond the stomach. A small but definite diaphragmatic hernia of the stomach was present.

Fluoroscopic examination of the colon: The barium entered the colon readily and filled it to a good size throughout. No filling defects were observed. There was a localization of the tenderness across the midabdomen apparently just below the transverse colon. Films of the colon showed a good filling throughout, but with evidence of a slight spasm. A long thin appendix shadow was visible. No barium was seen in the small intestine. There was evidence of some distention with gas of the upper small intestine and loops could be seen lying almost transversely in the mid and upper abdomen (Fig. 182). This was interpreted by the roentgenologist to be almost certainly evidence of obstruction in the small intestine.

Examination of the blood showed a white blood-count of 11,424, hemoglobin 95 per cent., and 5,570,000 red blood-cells. The blood-pressure was 150/98.

Vomitus.—There was 350 c.c., acid, dark brown, almost black, with no food, and positive for blood. A preoperative stomach aspiration showed 75 c.c. with a greenish color, acid, but negative for blood.

The *urine* was negative.

A presumptive diagnosis was made of acute obstruction, but probably incomplete in the small intestine, with complete ob-

struction to the passage of barium at the pylorus. The cause could not be determined, but with a complete obstruction at the pylorus and the irregular termination of barium in the antrum a carcinoma with possible extension or metastases to the intestines was considered.

Operation (July 7, 1927).—Morphin, gr. $\frac{1}{4}$; regional abdominal nerve block with a solution of $\frac{1}{2}$ per cent. procain with adrenalin.

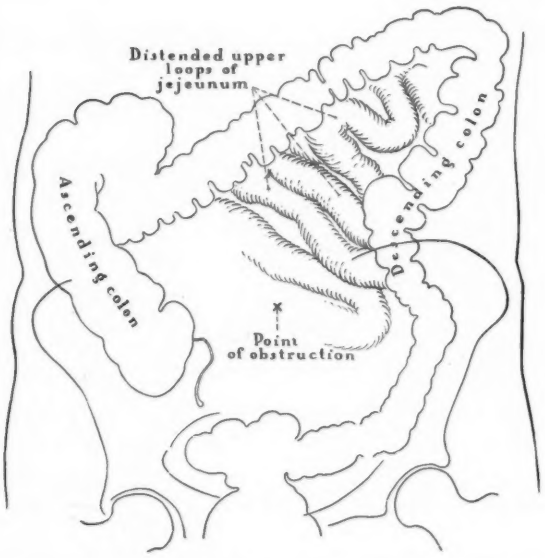

Fig. 182.—Drawing made from a roentgenogram. There were a number of coils of small intestine distended with gas, which were lying more transversely than normal, suggesting intestinal obstruction.

An incision was made to the right of the midline in the upper abdomen. A careful examination was made of the stomach, the gall-bladder, liver, and pancreas, which were negative. The transverse colon was lifted up and the lower abdomen was explored. The omentum, which was of good size, was noted to be fixed. The lower end of the omentum was seen to be bifid and the two ends encircled the jejunum near the middle of the

abdomen. A finger of each hand, inserted along each end of the omentum, extended deep down against the posterior abdominal wall underneath the mesentery of the small intestine and blood-vessels near its base. The opening on the left side was funnel shaped and led into a small deep hole of the mesentery. On the right side it was not funnel shaped, but simply a

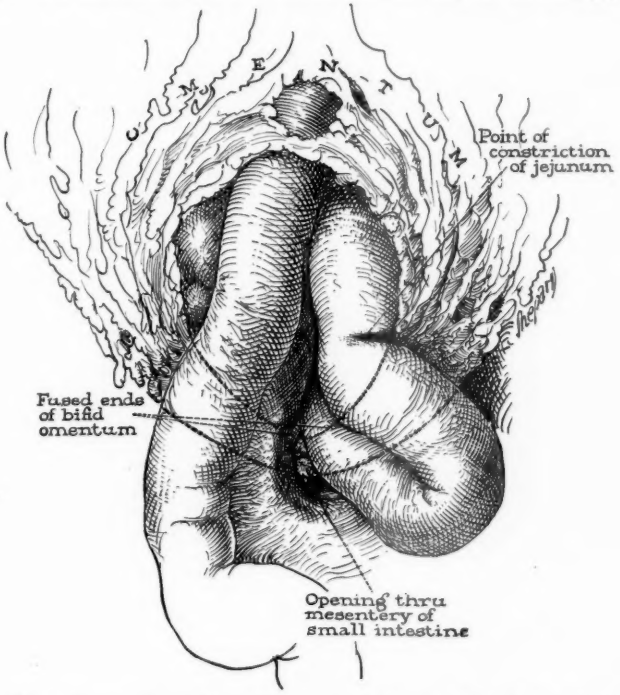

Fig. 183.—At operation. There was fusion of the ends of the bifid omentum through an opening in the mesentery which produced constriction and symptoms of acute obstruction of the upper jejunum.

round opening extending through the mesentery. The forefingers could be touched together through this hole along the fused ends of the omentum (Fig. 183). The omental ring formed by the fused ends was cut at one side and pulled through the opening. Immediately upon cutting through the ends of the

omentum a loop of the upper jejunum came into view, on the left side of the mesentery, with a discolored constriction ring extending about two-thirds around its wall. Obstruction was apparently not complete enough to strangulate the blood-supply. The constricted line was apparently not necrosed and resection was unnecessary. The bifid ends of the omentum were resected and the raw surface was closed with transfixion sutures. A thin cord-like appendix was examined and left. The abdomen was otherwise negative.

Pathology.—The removed part of the omentum consisted of an irregular sheet of fat tissue which weighed 33 grams and when laid out flat formed a thin sheet measuring about 13 cm. on its base and 3 to 5 cm. thick. The bifid end was formed by two round thicker portions with cut ends which when approximated formed a complete ring. There was no evident change in the dissected tissue as to the point where the ends had fused. Slightly above the base of the bifid ends there was a round opening in the omentum closed by a thin strand at the lower side (Fig. 183). The omentum was pale yellow to pink. All of the fat lobules were covered by a thin delicate white connective-tissue membrane and blood-vessels which permeated the connective-tissue stroma.

Microscopic Findings.—The sections consisted of fat and connective tissue containing a few round cells.

Course.—The patient made an uneventful convalescence. He stated that not only had the acute symptoms disappeared immediately, but that the stomach symptoms previously present upon eating had completely disappeared. Following operation, for the first time in his life, he had been able to eat large meals and relish his food free from any distress or fulness.

Discussion.—Openings and defects of the mesentery and the omentum have been classified by Prutz[1] as follows:

1. Congenital.
2. Spontaneous (through atrophy or rarefaction).
3. Accidental, traumatic.
4. Operative.
5. Result of chronic inflammation.

The mesentery in man usually begins at the duodenojejunal junction and extends from the left side of the body of the first or second lumbar vertebra to the right sacro-iliac joint. Treves[2] described the mesentery of the small intestine in embryonic life as a single fold of peritoneum attached to the vertebra and having its real root in the comparatively narrow interval between the transverse colon and the duodenum where the trunk of the superior mesenteric artery enters. After rotation of the intestine and the descent of the cecum the adult type develops with the fusion of the mesentery against the posterior wall, which is a secondary or acquired attachment. Treves found that the parietal attachment usually measured 6 inches. However, failure of parietal fusion with a persistence of the embryonic relations occasionally occurred. He described traumatic openings through the mesentery as usually slit-like, while the congenital ones were usually spherical.

In the dog one can constantly produce multiple holes in the thin avascular parts of the omentum by slight traction. It is possible that the defect above the bifid portion of the omentum in my case was due to traction by the ends. It would be possible for an opening beneath the mesentery to occur by a failure of complete obliteration along the line of acquired fusion to the posterior abdominal wall. The depth of the opening in my case prohibited detailed study. Treves has called attention to the fact that the greater number of openings occurred in the mesentery near the ileocolic juncture and that most of them may be considered congenital. He believed that they occurred through atrophy. He found the opening usually quite characteristic in appearance and constant in location. It developed in the center of a constant ring of anastomosing blood-vessels formed above by two branches from the ileocolic artery, one of which anastomosed to the left side with the last of the intestinal arteries from the superior mesenteric artery. The lower part of the circle was formed by the collateral branches along the ileocecal region. In the center was a very thin bloodless area free of fat and glands through which an opening could easily develop.

Among 31 cases where localization of the opening in the

mesentery of the small intestine was definite Prutz stated that it was located in 17 of them in the mesentery of the terminal ileum. In my case the opening was not in the ileocecal portion of the mesentery described by Treves, but deeply placed apparently beneath the large branches of the superior mesenteric artery and behind the thick fatty portion of the mesentery. This opening was below the region of the duodenojejunal fossa.

It is possible for an opening to occur through almost any part of the mesentery. However, there is normally no embryonic defect present, but a congenital developmental opening might occur from a lack of complete fusion of the mesentery to the posterior abdominal wall. Because of their rarity little clinical attention has been directed to the openings in the mesentery, although a few anatomists report the possible entrance and strangulation of a coil of intestine (Treves, Davis,[3] and Piersol[4]). Prutz reviewed 28 operated cases in which there was intestinal obstruction due to a looping through a hole in the mesentery of either the small or large intestine. There was recovery in 9 cases, 18 deaths, and 1 with outcome unknown.

Weinberg found that in infants the upper two-fifths of the intestine was arranged in transverse folds in the upper left part of the abdomen (quoted by Piersol, p. 1650). Certainly a considerable part of the upper jejunum was held in the left upper quadrant and partially obstructed in my case. Piersol (p. 1759) stated that the two opposed layers of the omentum and the transverse mesocolon upon which it lies fused at or about the time of birth. The possibility of a congenital fusion of the ends of the omentum through the mesentery is rather doubtful, since the omentum is not well developed during the early years of life.

There are two theories in regard to the change in position of the omentum. The theory of active movement is based on the common finding of the omentum wrapped about an inflamed viscus or foreign body. Some believe that this movement may be due to chemotaxis. The theory of passive movement assumes that any change in position is the result of movements communicated to it.

Florey, Walker, and Carleton[5] conducted a series of experi-

ments on the movements of the omentum in animals. They found that it was incapable of any intrinsic movements and that there was no attraction by inflamed areas of foreign bodies, but that it was passively moved about in the abdominal cavity by three factors. In the order of their importance they were: Changes in posture, chiefly bending movements; peristalsis of the gastro-intestinal tract; and movements of the diaphragm. The bending movement that most markedly affected the omentum was that of acute flexion, which was the position assumed in many instances of acute conditions of the abdomen. This position permitted the omentum to cover the largest amount of visceral surface.

The reason for the rapid adhesion and engulfing of inflamed areas or of foreign bodies by the omentum was due to the production of a layer of fibrin at the point of contact. The power of exudation and fibrin production by the omentum have been shown to be far greater than that of the peritoneum.

This has been shown to apply also to the bactericidal, phagocytic, and tryptic activity. Leukocyte emigration is very prompt, and there is organization of the fibrin by the blood-vessels and fibroblasts in a few days.

All movements of the omentum are thus shown to be entirely passive, while the power of adhesion lies in the exudation, which is greater than that of the peritoneum.

Probably during the first few years of life one end of the omentum was carried to a previously formed opening in the mesentery and in some manner was pushed through. The tip may have first partially strangulated, producing an exudation and fibrin formation to which the other end of the omentum became adherent, and with a blood-supply from both sides the point of fusion became lost. The mesenteric opening was so deeply located and so small that it would be impossible for a loop of intestine to enter, and, therefore, I did not attempt to close it at the operation.

Openings in the great omentum are occasionally seen and are due to the same causes as the openings in the mesentery. There are only a few cases described of obstruction due to

intestinal loops extending through them. A rare illustration was included by Prutz in which the entire omentum was a meshwork of openings between the blood-vessels.

In my case there was a fenestrated and also a bifid omentum which may have been congenital or due to either atrophy or traction by the ends. There was an associated double indirect inguinal hernia probably resulting from a congenital weakness and a small diaphragmatic hernia of the fundus of the stomach alongside the esophageal opening.

The complete relief of the chronic distress which dated back to early childhood makes it evident that constant pressure on the upper jejunum by the bands of fused omental ends had existed during all of this time.

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ABSCESS OF OMENTUM FOLLOWING APPENDECTOMY WITH PERFORATION AND GENERAL PERITONITIS AFTER FIVE MONTHS OF CHRONIC ILLNESS. RESECTION OF OMENTUM WITH COMPLETE RECOVERY

CHRONIC abscess of the omentum is probably not so rare as one might be led from the literature to believe. This may be due to the frequent difficulty of determining the exact pathology at operation when one may simply drain a localized abdominal abscess which is adherent to the abdominal wall.

Acute single or multiple abscesses are frequently seen at postmortem associated with a peritonitis or a perforated intestine, but are probably usually the result of a spreading extending infection.

Because of the idiopathic origin which may occur in either acute or chronic abscess I wish to mention later two unproved cases, one, of acute abscess and one chronic case of omental abscess both of which had no previous operation or evidence of visceral infection.

I shall present one proved case of chronic abscess of the omentum with perforation and general peritonitis five months after an appendectomy.

J. S., male, age nineteen years. The chief complaints on entering the hospital from a tuberculosis sanitarium were of abdominal pain, generalized muscle rigidity, and tenderness with fever and a toxic condition for one week, but becoming acute in the last eight hours. There was a palpable abdominal mass. This condition had started about ten days before with some diffuse abdominal pains and a fever of about 100° F. lasting for about three days, when he was examined by several doctors. Following this rather severe palpation of the abdomen he became gradually worse, but did not become critically ill until about eight hours previously.

The onset of his entire illness and disability started five

months previously, March 3, 1926, with an acute attack of appendicitis while he was at work. He was taken immediately to the hospital and operated elsewhere, and told that he had a bad appendix. The appendix was removed and the wound healed without any apparent complications. He was discharged from the hospital three weeks later in good condition. One month after operation he developed a cough with expectoration, but did not go to bed. He lost weight and had a fever of 99° to 101° F. His physician diagnosed pulmonary tuberculosis and sent him to a tuberculosis sanitarium for treatment, but no sputum was examined at that time.

Examination made at the time of entrance to the sanitarium May 21, 1926: The ankles were edematous. There was pain in the right leg and loss of weight and strength. The weight was 100 pounds, a loss of 33 pounds from normal. There was some cough and perhaps some dyspnea. The pulse was 116 and respiration 18. The temperature was 99° F. He was put to bed immediately and kept there all of the time until transferred to the hospital with acute abdominal symptoms.

Family History.—One brother died of tuberculosis during the past year. Father living and well. Mother died at the age of forty-nine, cause unknown. One brother and sister living and well.

Habits.—The patient had worked since the age of fourteen years, and at the time of the attack of appendicitis he was driving a light automobile delivery truck. There was a history of a mild attack of left pleurisy several years ago, but otherwise he had been well.

Laboratory Findings.—On entrance to the sanitarium about three months previously the Wassermann was negative, the hemoglobin was 65 per cent., the red blood-cells were 4,710,000, and the urine was negative. Ten examinations of the sputum were made while under observation, and they were all negative for the tubercle bacillus. Roentgenograms of the chest were made on entrance to the sanitarium. The report stated that there were some calcified areas about the hilus, and a slight haziness of the right upper lobe, but with no definite evidence of active

tuberculosis. There was an obliteration of the left costophrenic angle.

While in the sanitarium he was kept completely at rest in bed. The temperature was practically normal, with a rise of 1 degree a few times before the acute symptoms developed. During this time he gained 20 pounds, but lost a few pounds during the last week, with the development of the present symptoms.

Examination on entrance to the hospital five months after operation for appendicitis: The appearance was that of a very sick patient, face anxious and pinched, and complaining of severe general abdominal pains. The chest findings were negative. The abdomen was moderately distended. There was marked muscle rigidity, tenderness, and muscle spasm, especially in the lower abdomen. There was on old scar in the right lower quadrant. A mass could be palpated the size of an orange in the region of the umbilicus. There was no mass palpable in the rectum, although it was very tender. The white blood-count was 24,000. The urine was negative. A diagnosis of an acute abdominal condition was made, considering chiefly a volvulus or an abscess.

Operation.—August 11, 1926, under ether anesthesia.

A right rectus incision was made over the mass just to the right of the midline and below the umbilicus. The peritoneum was thick and edematous. The omentum was partly adherent to the wall at this region. On further examination I found a perforating abscess the size of a teacup with a necrotic wall involving a large part of the lower half of the omentum (Fig. 184). There was thick pus in this abscess cavity. The purulent fluid extended around all of the visible abdominal and pelvic intestines with a considerable amount of fibrin, but with no fibrous adhesions. The cecum was examined and the appendix was absent, with no adhesions at its stump. The omentum did not extend to the cecum, but was attached by fibrin to the base of the mesentery near the cecal region. There was no evidence of any source of infection outside of the abscess in the omentum, the walls of which were apparently old and thick-

ened. There was a recent perforation evidently due to an extending necrosis through the edematous anterior wall.

The omentum was freed from the slightly adherent overlying peritoneum and other fibrinous adhesion to the small intestines, and about three-fourths of it, including the large abscess cavity, was resected. The raw surface of the omentum was closed with transfixion sutures. Two cigarette drains were placed in the pelvis, and two along the right side of the abdomen, and the wound was closed in layers.

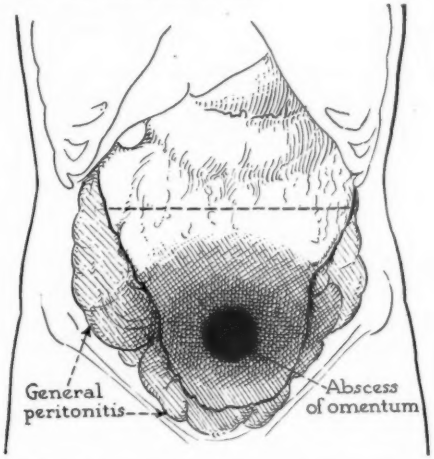

Fig. 184.—Chronic abscess of the omentum with perforation and general peritonitis developing five months after removal of appendix. The major part of the omentum, including the thick necrotic abscess wall, was resected as indicated by the interrupted line. Recovery.

The patient was quite sick for a few days, and then gradually improved, with cessation of drainage at the end of two weeks. He was discharged from the hospital eighteen days after operation. Three months later he weighed 128 pounds and had completely recovered. On roentgenographic examination at this time there was no evidence of tuberculosis in the lungs. One year later the patient was found to be perfectly well and working. He has had no complaints since the resection of the omental abscess and recovery from the general peritonitis.

Discussion.—In a recent review of inflammatory tumors of the omentum Vigyazo[1] found that there were barely 100 reported cases. He found a variety in these cases from the standpoint of the pathogenesis, the clinical course, and the findings. For the purpose of clearness I have made the following working classification of all swellings of the omentum:

I. Torsion of the omentum.

II. Tumors of the omentum.

III. Infectious or suppurative epiploitis.

Pathogenesis of infectious tumors of omentum:

1. Without previous operation.

(*a*) Primary bacterial embolic origin, without suppuration elsewhere.

(*b*) Secondary to a pyemic process with other foci of infection.

2. Following operation in which the omentum is not adherent, involved, or operated upon.

The process may develop by extension, contact infection, or a part of an embolic process.

3. Following operation in which the omentum has been adherent to diseased viscera or operated upon in some manner.

Infection may occur by extension, contact, operation, or injury following:

(*a*) Perforation of a viscus.

(*b*) Localized peritonitis.

(*c*) A suppurative thrombophlebitis or lymphadenitis.

(*d*) Perforating foreign body, as a swallowed pin, from the intestine, or a foreign body inserted at operation, or by an injury.

Clinical Types.—I. *Acute.*—(*a*) Occlusions of the blood-vessels (Kuettner-Schmieden type).

(*b*) Infections, including suppurative and non-suppurative.

II. *Chronic infections, including the Schnitzler-Braun type.*

The inflammatory tumors of the omentum may be acute or chronic. One acute type has been termed the Kuettner-Schmieden type. This often begins with fulminating symptoms and is mistaken for an attack of appendicitis or acute cholecystitis. By its sudden appearance the circumscribed necrosis

of fatty tissue occurring in these cases suggests an embolic origin. It is thought that embolic or thrombotic occlusion of the blood-vessels occurs in the Kuettner-Schmieden type of omental tumors.

In the second type of acute inflammatory omental tumor infection is responsible for the circulatory changes, although resolution may occur by absorption without discharge of the suppurative products.

The acute case I have seen was in a young girl twelve years of age, following a primary mild infection of the throat, with a localization after a few days of general abdominal symptoms into an abscess. At operation the abscess was adherent to the abdominal peritoneum and was merely drained. There was no better explanation than a probable embolic infection with suppuration in the omentum. A helpful, but not sure, differentiating point from acute appendicitis is that the general abdominal symptoms in omental abscesses may localize nearer the umbilicus or even to its left.

The chronic type has been termed the Schnitzler-Braun type. This form appears most frequently a few weeks to a year after an operation. After producing more or less severe abdominal symptoms it may disappear entirely under conservative treatment or soften in the center and on incision, heal after the emptying of necrotic fat (an oily fluid), a silk ligature, or some other kind of foreign body (needle or fishbone) (Vigyazo).

H. Braun[2] called attention to this type of epiploitis after resection of an interval appendix. Prutz[3] stated that the majority followed operation for hernia with resection of the omentum, operation upon the stomach, gall-bladder, and uterine adnexa.

In most cases there is a history of an adhesion of the omentum to the inflamed viscus or of operative trauma. In other instances there is no connection of the omentum to the operative field or previous operation. In such cases the possibility of embolic origin must be considered. French surgeons have attributed the usual origin to the action of ligatures where the omentum has been resected. This has occurred more often with silk ligatures, but occasionally with catgut. They believe that

the ligature may be contaminated, or that the ligation may be done in an already inflamed omental tissue.

The non-postoperative cases studied by Vigyazo usually developed after inflammatory disease or even perforation of some of the abdominal viscera, and at times after the primary disease focus had healed. In my case of probable chronic omental abscess without previous operation in a young woman, there were rather acute abdominal symptoms localizing somewhat to the left of the umbilicus. After about four months' careful observation, under a good physician, the general rigidity subsided, and a mass could be felt at the time I saw her. I thought at first it might be an infection from the uterine adnexa, although there was no local evidence. I made a posterior colpotomy under ether and found the uterine adnexa normal. I then cut down on the abdominal mass adherent to the thickened peritoneum and containing an abscess, which I drained without opening the peritoneal cavity. The wound healed rapidly without complications. No source could be found for the abscess.

It is quite probable that all 3 of my cases mentioned in this study were embolic in origin. The one proved case had symptoms of a suppurative bronchitis, and this may have been the source for bacterial emboli, or the pulmonary condition may also have been secondary to an infected thrombus from the appendectomy. However, previous operative soiling cannot be ruled out, although there were no adhesions to the stump of the appendix.

An omental tumor may develop in the vicinity of foreign bodies, as swallowed needles or fishbones, which have undergone perforation. A sponge or foreign body left in the abdominal cavity will be frequently surrounded by the omentum and form a tumor sometimes persisting for years without apparent symptoms. Symptoms of acute or chronic ileus may result from adhesions of the omentum.

Chronic inflammatory tumors of the omentum due to tuberculosis may also be included, although they will not be discussed in this study.

Elsewhere I[4] have described in detail torsion of the omentum without hernia, which is closely related to this group of inflammatory tumors. Torsion of the omentum with hernia occurs not infrequently, but without hernia it is rare and difficult to diagnose.

It should be considered in an obese middle-aged male with tenderness and an increasing cramp-like pain in the right side of the abdomen continuing for several days, following some unusual or violent physical exertion, especially in the absence of nausea or vomiting. The exquisite tenderness which is out of proportion to the other symptoms and cramp-like pains increased by movement are the most characteristic symptoms. Rigidity and muscle spasm, although usually not marked, may prevent the palpation of a mass. The temperature and pulse are not high and the white blood-count is lower than might be expected from the symptoms. There is sometimes bloody abdominal fluid. The preoperative diagnosis was usually acute appendicitis and occasionally acute cholecystitis. Especially when associated with a strangulated hernia a torsion of the omentum may be overlooked. At operation there is usually evidence of a pre-existing pedicle at the site of torsion. Early operative resection of the strangulated omentum should be done.

Conclusion.—Chronic abscesses of the omentum are probably not a rare condition. There is danger of general peritonitis from perforation of an abscess of the omentum and only gentle palpation should be done on examination. An omental abscess should be thought of when acute symptoms follow an operation, especially after a resection of the omentum or where the gastrointestinal tract has been opened, as after an appendectomy. The incision should be made over the mass, which will be frequently adherent to the abdominal wall, and if possible one should avoid entering or contaminating the general peritoneal cavity. In the review by Prutz there were 9 resections performed for inflammatory tumors of the omentum, with 3 deaths.

After perforation into the general peritoneal cavity resection of the abscessed part of the omentum should be done if feasible, since its removal will favor recovery from a peritonitis.

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USE OF A CORTICAL INLAY BONE-GRAFT IN NON-UNION. IMPORTANCE AND TECHNIC OF AVOIDING ENCIRCLING BONE SUTURES. A CLINICAL AND EXPERIMENTAL STUDY

LARGE bone-grafts are now less frequently used in non-union, where fixation and support are unnecessary, than thin periosteal cortical grafts or multiple chip grafts.

The method of choice for bone fixation in the operative treatment of recent fractures must depend upon variable conditions in each instance. Not infrequently some foreign substance, such as a screw or a plate, may be useful. It has been found that while osteogenesis is retarded by foreign substances, it is stimulated by the autogenous periosteal covered bone splint, which is a practical method of fixation. In all cases where osteogenesis has ceased, as in healed fractures with malunion or in non-union, a foreign substance should be avoided and some method of bone stimulation should be considered, including freshening the ends of the fragments.

I have classified fixation bone-grafts and foreign material splints into the following groups:

A. Longitudinal.

1. Extracortical, steel or bone plates.
2. Intramedullary, autogenous or beef bone, ivory or metal splints.
3. Inlay cortical bridge grafts, autogenous or beef bone.

B. Encircling bands (Parham and others), wires, non-absorbable and absorbable sutures.

C. Penetrating materials, bone or metal screws, wires, or surgical suture materials.

In a number of fracture experiments on the tibia of animals I observed an interference in callus formation about an encircling suture, and where infection occurred there was an underlying necrosis in a couple of experiments with the medullary

canals plugged. This is suggestive evidence against encircling sutures and non-absorbable materials.

In a group of experiments I cut out and replaced a piece of cortex consisting of about one-third of the shaft of the tibia in animals. I inserted a small wooden plug very tightly in the medullary canal above and below this opening. The fragment was then replaced in the opening from which it was removed and fixed in place with two linen sutures tied completely around the shaft and the fragment.

A failure of callus formation occurred constantly about the encircling sutures, although infection occurred in a large percentage of this group. A complicating fracture occurred in nearly all of these experiments through the remaining portion of the tibial shaft. This happened usually after ten to twenty-five days in spite of the application of a temporary cast to the leg. Non-union always occurred in the infected fractured legs, but in the non-infected fractures union usually occurred after a period somewhat longer than usual.

In a second group of experiments I resected a segment of the entire shaft of the tibia and inserted a small autogenous bone-graft, but without plugging the medullary canal. The fibula was not fractured at the time, but it occasionally resulted later. Union of the tibia occurred in nearly every case and infection was rare.

In a third group of experiments I resected about $\frac{1}{2}$ inch of the tibia, leaving the fragments held apart by the intact fibula. The medullary cavity was undisturbed. Union occurred in about one-half of these experiments.

In a few experiments I cut the tendon and muscles of the leg in the region of a produced fracture of the tibia. In other experiments I turned a muscle or fascial flap between the fractured ends of tibia. There was non-union in all of these experiments.

Clinically, it has been shown that the Parham or other encircling bone-fixation bands may occasionally produce a ring of necrosis beneath them (Leveuf[1]). Although this necrosis may have been due chiefly to applying the bands too tightly, there

may be a slight aseptic necrosis around any foreign material, especially screws and plates.

In a clinical case of bone-graft to the tibia for non-union I have observed on the roentgenogram a callus defect with some

Fig. 185.—Roentgenogram three months after operation in a clinical case. Marks indicate outline of long inlay graft inserted for non-union. There are callus defects with some apparent absorption to be seen in the region of the partially encircling fixation sutures, but good union resulted.

apparent absorption where the kangaroo tendon fixation sutures were applied about a part of the shaft and the graft (Fig. 185).

A defect in the callus might interfere with the vitality of a part of the graft. Cotton[2] has complained of the frequency of union of only one end of an inlay bone-graft with failure of fracture union. Encircling sutures or bands may interfere with the longitudinal blood channels by local absorption and irritation. I believe that any encircling suture or splint should be avoided where possible and replaced by a longitudinal splint or penetrating method of fixation.

In non-union and in malunion bone formation has usually ceased and may be inadequate even after freshening the ends of the fragments and operative approximation. Penetrating methods of fixation are rarely so feasible as a longitudinal splint which should aid osteogenesis. In choosing a longitudinal bone-graft splint I believe that the intramedullary method should be avoided, although it may be more convenient from a mechanical viewpoint.

The autogenous cortical inlay bone-graft has advantages here in both maintaining fixation and stimulating bone production. However, it should be cut from the more cancellous medial side of the tibia and not from the hard dense crest. Periosteal grafts including a thin outer layer of the cortical bone and multiple chip grafts stimulate osteogenesis, but are of no value for fixation. They may be used in addition to any of the methods of fixation and are of proved value.

In the fixation of a rather long bone inlay graft, clinically, I have usually used the partially encircling method drawn in Fig. 186, A. This avoids encircling more than about one-third of the shaft. However, these sutures may produce callus defects and also irritation and absorption of bone (Fig. 185).

A study of my experimental and clinical work has led me to use longitudinal sutures where possible. The method in Fig. 186, B permits the suture to pass along the shaft longitudinally, but it passes between the graft and the healthy bone and may produce some irritation and callus defect. This may be one factor in the frequent non-union of one end of the graft reported by Cotton.

The method which at present appears to be the best for

avoiding undesirable encircling fixation sutures is shown in Fig. 186, C and D. In a cross-section (C) the technic is shown a little more clearly. The suture passes longitudinally along both the healthy shaft and the bone-graft, thus avoiding, as much as possible, any circular interference or possible absorp-

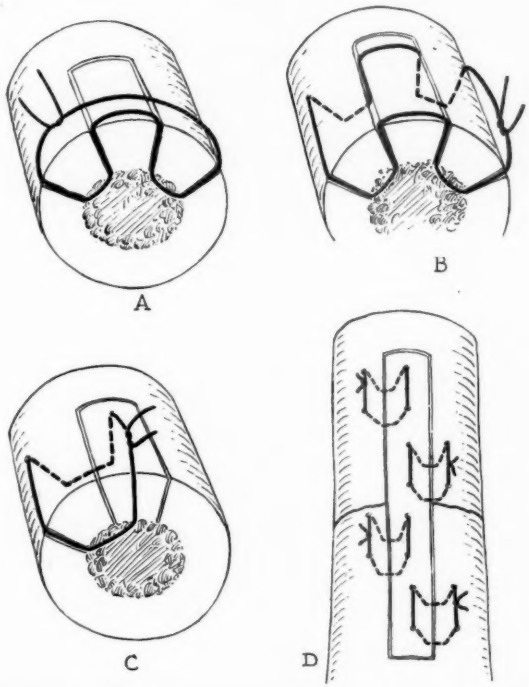

Fig. 186.—Diagram A illustrates former fixation suture methods with undesirable encircling of the shaft. Diagram B is a slightly improved method. Diagrams C and D illustrate an improved method of fixation sutures which avoids encircling or the presence of suture material between the graft and the shaft.

tion involving the longitudinal blood channels. The suture also avoids the points of contact of the graft and the shaft with a possible interference in early vascularization and nutrition of adjacent bone and periosteum. The drilled holes in the graft

for the introduction of the sutures do not perceptibly weaken the graft and may be advantageous in permitting earlier vascularization. Kangaroo tendon has been a satisfactory suture material.

Clinically I have found this method (Fig. 186, D) satisfactory with the use of two sutures through four drilled holes at each end of the graft.

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CLINIC OF DR. OSCAR NADEAU

AUGUSTANA HOSPITAL

DIFFERENTIAL DIAGNOSIS OF CARCINOMATOSIS AND TUBERCULOUS PERITONITIS BY MEANS OF THE CYSTOSCOPE

THIS is a case in which we feel that it is highly important for a number of reasons to know just what pathology is present in this abdomen. The following history has been obtained:

The patient is a married woman of fifty-one years, and a housewife.

Present complaint is (1) vomiting and "heart-burn"; (2) swelling of the abdomen; (3) pain in the abdomen and back.

Present Illness.—Except for occasional dyspeptic attacks for many years the patient has been in good health until September, 1927. At that time she noticed that she became fatigued easily, lost her appetite, and the right side of the abdomen seemed to be bloated. These symptoms were present until January, 1928, when she felt much improved. In October she had an attack of pleurisy, and her physician informed her that there was fluid in the pleural cavity at that time. During January and early February of this year she felt quite well, and was up and around and gained weight. Approximately one month ago she had a sudden, severe attack of pain in the lower portion of the back and felt a "snapping," which caused her to fall. She was able to get up without help, however. Immediately following this she began to notice an enlargement of the abdomen. There has been a hungry, gnawing feeling in her epigastrium the past three weeks. During the past winter the stools have been small in amount, and, as she says, "ribbon-like." There has been no blood seen in the stools. Although she vomits occasionally, at irregular intervals, she has not vomited blood.

Past History.—Influenza in 1921. Hemorrhoids since a child. Pleurisy in 1926. There had been no operations.

At present there is no cough, no pain in the chest, no edema of the ankles after standing, but she has noticed some shortness of breath when climbing stairs. Menstruation was always regular and normal up to five years ago, when the menopause came on. There has been no vaginal bleeding since, and she has no vaginal discharge. Her best weight was 179 pounds, one year ago. At present she weighs 148 pounds.

Physical Examination.—This is a fairly well-nourished woman, age about fifty, whose general examination of the head and neck is negative. In the chest the heart is normal in rate, size, and position, and there are no murmurs. A careful examination of the lungs reveals no evident pathology. The abdomen is markedly distended and tense, and a fluid wave is easily demonstrated. In the upper right quadrant of the abdomen is felt a tender, irregularly shaped mass below the edge of the liver. No other organs are palpable because of the tenseness of the abdomen. Varicose veins of both legs are present.

Upon bimanual examination is found a dough-like mass apparently situated in the right broad ligament, and about the size of a hen's egg. The uterus itself is small and somewhat displaced to the left, but movable. Rectally there are small internal hemorrhoids, but no other pathology determined with the examining finger.

x-Ray Examination of the Chest (February 9, 1928).—Fluoroscopic study and stereoscopic roentgenograms reveal that the apex on the left is normal in size and radiance. The apex on the right is slightly diminished in radiance.

On the left the lung markings extend upward, outward, and downward, and do not reach the apices or periphery. The diagram is normal in position, outline, and excursion, and the costophrenic angle is clear.

The base of the right chest is characterized by a homogeneous shadow of increased density whose upper border rises at the axillary line. Above this shadow of homogeneous density, and extending along the right border of the spine, is an irregular shadow

of increased density, which appears to arise from the hilus and mediastinum.

The cardiac shadow is somewhat displaced to the right. There is also a calcified area which lies over the shadow of the first rib anteriorly.

Conclusion.—Radiographically: the findings at the right chest are those of a small amount of fluid at the base associated with what appears to be a consolidating process which is somewhat irregular in nature. The findings are not characteristic, but are very suspicious of the findings produced by metastases.

Comments.—It is quite evident, of course, that there is a growth in the abdomen producing ascites in this case, and one should think of (1) carcinomatosis, (2) cirrhosis of the liver, and (3) tuberculous peritonitis. In view of the fact of her age and the fairly typical history, a clinical diagnosis of carcinoma of the abdomen with fluid is made.

Abdominoscopy (February 10, 1928).—This morning I should like to demonstrate to you the use of the cystoscope intraperitoneally. We have given this woman $\frac{1}{4}$ grain of morphin an hour ago, but you see she is quite alert now. We shall prepare the abdomen in the usual way with alcohol and tincture of iodin, and drape off all but the right upper quadrant, selecting an area just over the tumor mass that we felt, which is approximately 4 cm. to the right of the umbilicus. I inject a small wheal of skin with 1 per cent. novocain solution, then with a longer needle inject, perpendicularly to the skin, the deep fascia, and then the peritoneum. With a sharp scalpel an incision is made, exactly $\frac{3}{8}$ inch long, through the skin. Through the wound is inserted this three-cornered trocar, which is carefully passed through to the peritoneum. You notice that I rotate the trocar slowly, and in that way require very little pressure to cause the trocar to pass through the tissues. Now the trocar is in the abdominal cavity. I now remove the trocar, and immediately insert, through the channel which has been made, this direct vision (Braasch) cystoscope, which has previously been sterilized. You will notice that the cystoscope easily passes through into the abdomen and that the skin edge

hugs the wall of the instrument, thereby eliminating all leakage. Upon removal of the obturator from the cystoscope, we have a gush of light brown colored fluid (the actual amount of the fluid removed was 4700 c.c.). I now adjust the window of the cystoscope, and attach the sterilized light connection. With this ordinary atomizer bulb, which has been sterilized and con-

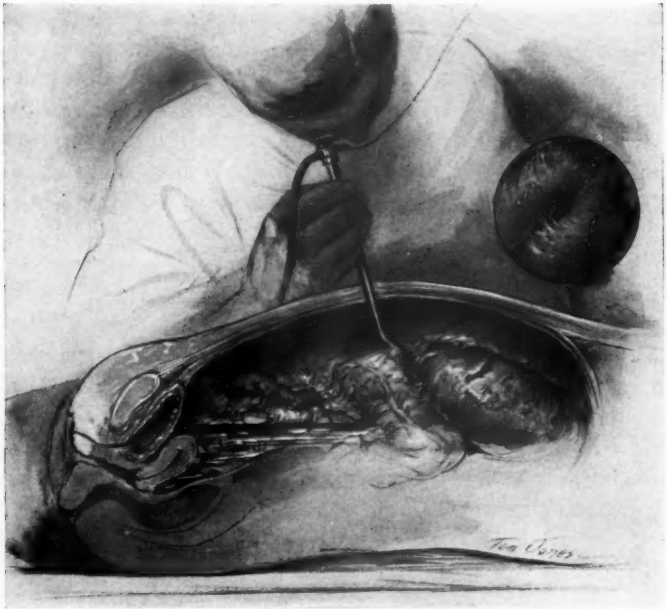

Fig. 187.—Sagittal section showing use of abdominoscope. The abdominal wall is lifted from the organs by means of air, giving a good view of the tuberculous masses. *A* shows tubercles and adhesions on the ileum as viewed through the cystoscope.

nected with the cystoscope, I now carefully inflate the peritoneal cavity with air until the abdomen is nearly as large as it was before removal of the fluid. Looking through the cystoscope I now see a large, rugged, irregular, grayish mass overlying the transverse colon, pylorus, and a loop of small intestine, part of the material also extends to and around the liver surface. On the

liver are seen a number of small grayish spots, each the size of the head of a pin, and surrounded by a small red areola. These small spots are also seen overlying the coils of small intestine, especially around the ileum and cecum. In the pelvis is seen a conglomerate mass surrounded by many adhesions. The peritoneal covering is generally and moderately injected. Those of you who care to may see a typical condition of tuberculous peritonitis through this instrument (a number of the doctors were able to see the tubercles quite readily). I now remove the window from the cystoscope and allow all of the air to leave the abdomen, using careful massage to express the few remaining bubbles. The cystoscope is now removed, and a small piece of sterilized adhesive plaster put in place to close the wound. It is not necessary to use a stitch as the wound is so small.

We now have a definite diagnosis in this case without having produced the slightest pain or discomfort to this woman, and it has done her, in our experience, no harm whatever. We have used this method many times (as described in a previous article published in Surgery, Gynecology, and Obstetrics, September, 1925), both with and without ascites. When there is no ascites, we produce a preliminary pneumoperitoneum before introduction of the trocar, otherwise the method is the same.

Summary.—A case of ascites, diagnosed "carcinomatosis," was found by adominoscopy to be "tuberculous peritonitis."

CLINIC OF DR. VERNON C. DAVID

PRESBYTERIAN HOSPITAL

SURGERY OF THE BILIARY TRACTS

WE should like to present the history and findings of 3 patients suffering from lesions of the biliary tracts. They present some features of interest because of difficulty of diagnosis and because of the unexpected findings at the operation.

Case I.—The first patient, Mrs. W., was referred by Dr. Donald Abbott. She is sixty-one years of age and comes in because of jaundice, general weakness, loss of 35 pounds in weight, and a dull, aching pain in the right upper quadrant. She also has occasional spells of nausea and vomiting. She was perfectly well before the onset of these symptoms eight months ago, which were insidious in their appearance, the jaundice first being noticed by her daughter. During the last eight months the jaundice has deepened and has been constant with but slight fluctuation in its intensity. The stools have been clay colored, the urine dark, and there has been some itching of the skin.

At first nausea and vomiting was accompanied by dull pain in the right upper quadrant. This occurred every two days during the first five months, but lately there has been practically no nausea or vomiting. She has never vomited blood nor has she noticed blood in the stool, which has been white and clay colored through practically all of this illness. She still has attacks of dull pain over the liver and in the back. On one occasion she had a slight chill and temperature of 101° F.

Her loss of weight has been gradual. There have been no other symptoms of importance.

Concerning the past history she states that four years ago she had a spell of nausea and vomiting which accompanied a slight apoplectic stroke, all evidence of which has since disappeared.

Fig. 188.—Case I. Flat plate showing possible gall-stone which was shown at operation to be in the common duct.

In the general examination, besides a deep icterus, acholic stools, large amounts of bile in the urine, and a slightly enlarged liver, there were no positive findings of disease to be demonstrated.

In considering the possible causes of her condition it is obvious that the occurrence of a practically silent jaundice with

nausea and vomiting lasting over several months would first bring to mind the possibilities of carcinoma of the stomach, carcinoma of the bowel with metastases to the liver, carcinoma of the head of the pancreas with obstruction of the common duct at the ampulla of Vater, or pressure of the common duct from without by enlarged glands or a tumor. Consequently an *x*-ray examination of the stomach was done, which showed a normal stomach. A fluoroscopic examination of the bowel showed it to be normal. In addition, there was no blood in the stool. This practically limited the diagnosis to carcinoma of the head of the pancreas or stone in the common duct. Flat *x*-ray plates had shown a faint round shadow constant in position and with concentric rings which had the appearance of a gall-stone. This shadow could easily have been overlooked and was only considered of interest after several plates had been taken showing it maintaining the same position in all of them. The Graham-Cole test was not done because of the complete obstruction of the common duct.

In favor of carcinoma of the head of the pancreas was a silent jaundice in an elderly woman, who was extremely emaciated, and who had no history of gall-stone colic. This diagnosis had been made elsewhere and the patient advised against operation.

In favor of common duct stone was several slight variations in the intensity of the jaundice, absence of a palpable dilated gall-bladder which should be expected with a tumor obstructing the common duct, and, in addition, the occurrence of a faint shadow with concentric rings seen in *x*-ray in the liver region.

Consequently, a probable diagnosis of common duct stone was made and exploratory laparotomy advised.

As the blood-clotting time was under four minutes, no preliminary treatment with calcium was indicated.

Under ether anesthesia an incision was made over the mesial portion of the right rectus muscle, which, after division of the fascia covering it, was drawn to the right side and the abdomen was opened. The liver was large, hard, and covered with fine indentations. Its color was dark brown. The duodenum and

transverse colon was adherent to the under surface of the liver. These adhesions were separated by sharp dissection and the hepatoduodenal ligament brought into view. In the middle of the common duct was a stone about ¾ inch long and about ½ inch thick. It was firmly fixed in the duct, which above the impacted stone was dilated very markedly. The gall-bladder was very small and contracted. A finger inserted under the common duct brought it well up to the abdominal wall. An incision was made over the stone which was very easily removed and a T-tube was sutured into the common duct, one branch pointing upward toward the hepatic ducts and one branch downward toward the duodenum. The stem of the T-tube was brought out through the abdominal wall. The gall-bladder was not disturbed. A rubber-covered cigarette drain was placed down to the region of the common duct.

The postoperative course was uneventful, although the jaundice cleared very slowly. The T-tube which was attached to a bottle drained 177 c.c. the first twenty-four hours, 370 c.c. the second twenty-four hours, and about 300 c.c. a day for the next ten days. The amount then became less and the bile in the stools became more and more apparent. The T-tube was removed twenty days after operation. At that time the jaundice was very much less apparent in the skin. The bile drained in small amounts from the sinus following removal of the T-tube for about another week.

Since her operation a year and a half ago the patient has been in excellent health and has regained her normal weight and strength.

Case II.—The second patient, Mr. C. W., sixty-five years old, was referred by Dr. Ralph C. Brown. The patient entered the hospital because of severe colic in the right upper quadrant, the loss of 30 pounds in weight during the last six months, and a light jaundice which has been present intermittently.

The pain complained of is that of typical gall-stone colic except that the patient never vomits during the attack and that the pain is never referred to the back or scapula, but remains in

the upper abdomen and under the right costal arch. The attacks of colic have been frequent. He has had fifteen attacks in the last three months, some lasting from ten to fourteen hours and practically all requiring morphin.

The jaundice has never been deep and he has had normal colored stools. However, when he entered the hospital bile was present in the urine.

The general physical examination has been negative except for tenderness over the gall-bladder and bile in the urine. The stomach contents were normal and the fluoroscopic examination of the stomach and colon was negative. A Graham-Cole dye test by intravenous injection failed to show a gall-bladder shadow on the nine o'clock, twelve o'clock, and one o'clock films. The inference was therefore justified that bile could not enter the gall-bladder and the most probable cause of the obstruction was a stone or stones in the cystic duct, or a gall-bladder completely filled with stones.

In spite of the patient's age and because of repeated severe gall-stone colics and occasional jaundice, with marked loss of weight, operation was advised, with a diagnosis of stones in the gall-bladder.

Upon opening the abdomen through a right paramedial incision the gall-bladder looked and felt normal, with the exception of a few fine adhesions between the gall-bladder and the duodenum and a rather marked edema of the cystic duct, and the loose areolar tissue around it. The common duct was not perceptibly dilated and no stones could be felt in it. The hepatic duct which could be well exposed was dilated to the size of a forty-five caliber bullet and its wall was thin and semi-transparent. At the entrance of the right hepatic duct under the liver a stone could be palpated that was firmly impacted in the duct. The hepatic duct below the stone was opened, but fine grasping forceps were unable to engage the stone or dislodge it. However, with the thumb and index-finger above the stone on the under surface of the liver, it was finally milked down to the opening in the hepatic duct and removed. The stone was black and hard and not faceted. It was about the size of a shelled

peanut. A probe was passed through the opening in the hepatic duct through the right and left branches of the hepatic duct and through the common duct into the duodenum without encountering any stones. A small catheter was inserted upward into the right hepatic duct and sutured into place. The gall-bladder was opened and found to contain bile, but no stones. It was drained.

The patient made an uninterrupted recovery and left the hospital three weeks from the day of operation. The bile drained from the hepatic duct and gall-bladder and in amount averaged about 300 c.c. a day. The catheter was removed from the right hepatic duct on the eighth day and the drainage-tube was removed from the gall-bladder on the ninth day. There was slight drainage of bile for two weeks after removal of the drainage. Six weeks after the operation the patient was seen. He had gained 10 pounds and his incision was firmly healed.

There are several interesting points to consider in connection with the Graham-Cole dye test as it was carried out in this patient, as related to the findings at operation. As will be remembered, the gall-bladder was not visualized after intravenous administration of the dye, and it was therefore assumed that either the gall-bladder was full of stones or there was an obstruction of the cystic duct, as at the time of the test the only evidence of jaundice was a slight amount of bile in the urine. At operation the gall-bladder contained no stones, but did contain bile. There was some slight edema about the cystic duct. In this connection it is interesting to note that the main hepatic duct was dilated, though there was no stone in the common duct and the only stone found was high in the right hepatic duct. It must be assumed, therefore, that a stone had been present at the junction of the cystic and common duct which prevented the entrance of bile into the gall-bladder and at the same time caused a dilatation of the hepatic duct proximal to the stone. We must also assume that this stone had been passed into the duodenum or had retrogressed into the right hepatic duct. It is not reasonable to believe that the stone had remained any considerable time in the common duct, as that duct was not dilated. It is

hard to believe that the dark, hard impacted stone in the right hepatic duct had formerly been in the gall-bladder. We therefore concluded that the stone which had been present in the cystic duct had passed through the common duct into the duodenum prior to operation

Case III.—Mrs. E. D., thirty-six years of age, was referred by Dr. George Dick. She has had numerous typical attacks of gall-stone colic during the past year. She also had some annoying discomfort in the epigastrium coming on about two hours after eating, which has been present intermittently for several years. There has also been considerable discomfort from a feeling of pressure in the epigastrium. Patient appeared very well. She has not been jaundiced.

The examination of the patient revealed no abnormal findings except tenderness over the gall-bladder. A Graham-Cole dye test given intravenously failed to give a visualization of the gall-bladder, but flat *x*-ray plates showed a definite round shadow in the gall-bladder region which looked like a gall-stone. The assumption was that this single stone obstructed the cystic duct, preventing bile from entering the gall-bladder. An operation consequently was advised.

Through a right paramedial incision the gall-bladder was found to be of whitish-gray color, thickened, and it contained a rather large stone in the cystic duct. The common duct was not dilated and contained no stones. On examination of the stomach there was a small lesion about 1 cm. in diameter on the anterior wall, about 1 inch proximal to the pyloric ring. This lesion was slightly indurated and it was questionable whether it was an ulcer or a small tumor of the stomach wall. After removal of the gall-bladder from above a piece of this indurated lesion was excised for microscopic examination. It was felt that if the lesion were a small ulcer it would heal under medical management and that gastro-enterostomy and complete excision of the lesion were not indicated. Two cigarette drains were placed down to the stump of the cystic duct.

Cultures made from the bile in the gall-bladder grew a non-

hemolytic, non-green forming streptococcus. In the lumen of the gall-bladder one large stone and several small ones were found. Microscopic examination of the gall-bladder wall showed a round-cell and polymorphonuclear infiltration.

Examination of the small piece of tissue excised from the gall-bladder wall showed that it consisted largely of small muscle cells separated by polymorphonuclear leukocytes. A chronic inflammatory lesion was diagnosed, and the assumption taken that a small ulcer was present on the mucosal side of the stomach wall.

The convalescence was uneventful. The tubes were removed on the eighth day and she left the hospital three weeks after operation with the wound completely healed. She was put on medical ulcer management by Dr. Dick.

Everything went well for about six months, when the patient came in complaining of severe pain in the epigastrium especially after eating. She had lost some weight and stated that the discomfort was increasing rather than improving. She was therefore kept more strictly under observation, and ten months after her operation was re-entered into the hospital. The thought that occurred to us was that either she had a small chronic ulcer or that the lesion we had suspected of being a small ulcer had been a carcinoma, or that she had a stone in the common duct that we had overlooked. We did not incline to the latter assumption because her pain at this time was related more to food taking and there had been no jaundice accompanying it.

At this time a careful examination failed to reveal any general findings except some loss of weight. The fluoroscopic examination of the stomach showed good peristaltic waves through the antrum except for a thin place at the prepyloric portion which was seen repeatedly (Figs. 189, 190). The cap seemed small. There was good emptying of the stomach. With the patient in the upright position the waves closed off the stomach to the end of the antrum and the thin area was not seen. Several of the films taken showed evidence of narrowing of the duodenal cap, and the thin area in the prepyloric portion of the antrum was well depicted. This suggested a small mass, and

we were prepared to think we had made a mistake in not excising the lesion of the stomach during the first operation.

Reoperation was advised and carried out. After excision of the old abdominal scar the abdomen was opened. The great omentum was found adherent to the anterior abdominal wall

Fig. 189.—Case III. Flat plate showing stone in gall-bladder.

and the under surface of the liver. The duodenum and pylorus were firmly adherent to the under surface of the liver.

There was no ulcer palpable or visible in the stomach or in the duodenum. The stomach and duodenum were dissected free from the liver. The pancreas was small and not increased in

density. A finger in the lesser peritoneal cavity revealed no pathology in the common duct or on the posterior wall of the stomach. As much as possible of the raw surface of the liver was covered and the abdomen closed. After a somewhat painful three or four days of convalescence the patient made an

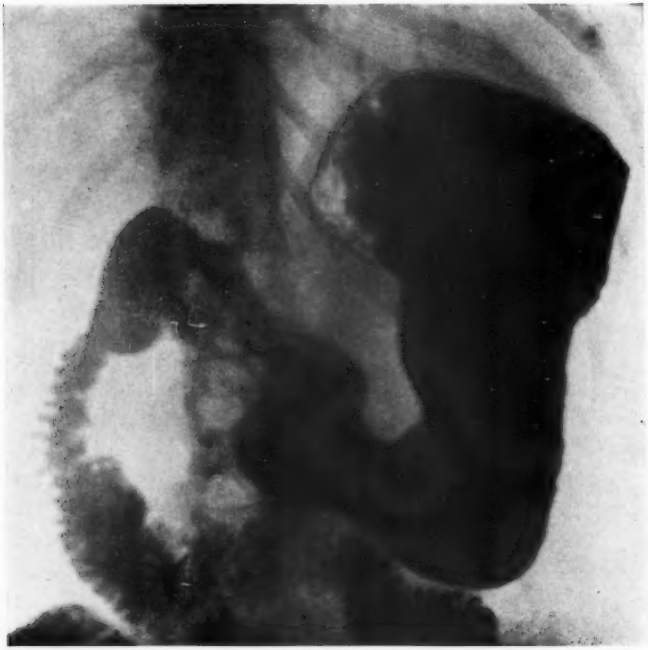

Fig. 190.—Case III. Deformity of stomach due to adhesions uniting stomach and duodenum to under surface of the liver.

uneventful recovery and has been well and free from symptoms up to this time, which is seven months from her last operation.

The diagnosis in this latter condition was, therefore, postoperative adhesions which so deformed the duodenum and stomach that marked abdominal pain resulted which was difficult to interpret.

CLINIC OF DR. DAVID C. STRAUS

MICHAEL REESE HOSPITAL

WALKING SPLINT FOR DELAYED UNION AND NON-UNION OF FRACTURES OF TIBIA AND BOTH BONES OF THE LEG

THE time required for union of fractures of the tibia may vary within wide limits, just as is the case with other bones, and is dependent on many factors. The average time required for consolidation in fracture of the tibia is six weeks, and ordinarily, at the end of five weeks, the fracture will be found to be very firm. However, no weight bearing (without splint support) is allowed before the eighth week. As has been pointed out by Paul, 82 per cent. of fractures of the tibia will be solidly united within seven weeks, and 78 per cent. of fractures of the tibia and fibula will be solidly united within nine weeks.

In fractures of the upper third of the tibia union is slower than in fractures in the lower two-thirds. The reason for this is not known. However, this is not the portion of the tibia in which non-union usually occurs.

The common site of non-union is in the lower third of the tibia and this is not infrequent. Bone repair is not very vigorous in this portion and, occasionally, even though proper alignment, contact, and fixation are secured and the patient is free from the various constitutional conditions which contribute to non-union, non-union occurs.

It is most important to distinguish between delayed union and non-union. Union may take place very slowly and may require months. It may be long delayed, and occasionally may take six to eight months or even longer. Non-union may occur as early as a very few months. The old teaching, that a fracture which is not solidly united after three months' time constitutes

a case of non-union, has long since been proved erroneous. Today we recognize that it is not so much a matter of time. The essential feature which distinguishes delayed union from non-union is the condition of the bone ends at the site of fracture. This can be learned from a proper interpretation of good roentgenograms. Whenever roentgenograms show that the process of repair has come to a standstill before union has occurred, non-union exists.

It is most essential to distinguish delayed union from non-union because the indications for treatment are so different.

Non-union calls for operation, and without undue delay. Operation alone can accomplish union. If, for any reason, operation is contraindicated or is refused by the patient, recourse must be had to the permanent use of a suitable supporting apparatus to hold the bone ends in place and prevent angulation so that the patient will be able to walk.

Delayed union calls for expectant non-operative treatment. Operations performed in cases of delayed union can properly be classed as meddlesome surgery and should be carefully avoided. Open operation here may interfere with the local blood-supply and thus only further delay union. Acupuncture, iodin injections, serum injections, drilling multiple holes, and the like, have proven of little or no avail. Our most effective means consists in the use of a firmly fitting walking splint, and the use of massage and diathermy. If there is a deficiency of calcium or phosphorus in the system, the administration of calcium and phosphorus may be of value. Calcium phosphate, yellow phosphorus, and cod-liver oil administered by mouth apparently aid the production of callus in some cases of delayed union (Petersen, Phemister, and Scudder). The stimulation resulting from function, that is, walking with the aid of a suitable brace even for months, will often cause a fracture finally to heal.

Confronted with a case of stubborn non-union I devised an appliance which has proved satisfactory in every way. It is a development of the basic idea of an appliance described by André Trèves in Chirurgie Reparatrice et Orthopedique, vol. ii, pp. 406–408, published in 1920. The outstanding difference

from all other appliances for this purpose consists in the fact that the brace is laced down the back instead of in front, and this is of the greatest importance, as it allows the anterior portion of the brace to be accurately molded to fit the tibia, while the lacing can be adjusted to suitably press the calf muscles firmly up against the bones.

The brace consists essentially of a sole-leather sheath shaped to exactly conform to a plaster cast of the leg, and two lateral steel braces. The principle of the apparatus is to give a point of support above the seat of fracture so that the lower fragment hangs more or less free and bears no weight. The points of support consist of the head of the tibia, the tuberosity of the tibia, and to a less extent the head of the fibula.

The sole-leather sheath, or puttee, shaped exactly to conform to a plaster cast of the leg, is made to surround the leg from just below the patella to just above the malleolæ. This leather sheath opens and laces posteriorly (Fig. 191). It is logical that the front should be closed and accurately conform to and support the tibia, for that is where the weight is borne, and by having the lacing in the back, over the calf muscles, by properly adjusting the tension of the laces, adequate pressure can be exerted on this muscle mass to press the tibia firmly against the leather splint.

Two lateral vertical braces of heavy metal are united in front by two broad metal bands, which closely fit the leather sheath, one at the upper part, where this surrounds the head of the tibia and fibula (Fig. 191, 1), and a lower one a short distance above the top of the shoe (Fig. 191, 2). Below, the vertical bars are fastened to a metal footpiece which encircles the sole of the shoe at the heel (Fig. 191) by means of a hinge-joint, one on each side, at the level of the tibiotarsal articulation (Fig. 191, 3). The center of this joint is 2 cm. above the tip of the internal malleolus.

In order to prevent any rotation of the fragments and during the early stages of healing to further relieve the site of fracture from weight bearing, the upper ends of the two lateral vertical metal bars are attached by hinge-joints to two similar bars which

extend from this point upward to a heavy leather cuff which fits up closely beneath the tuberosity of the ischium (Fig. 191). This leather cuff is well padded and when the patient walks supports the weight from the ischium, transmitting it to the heel.

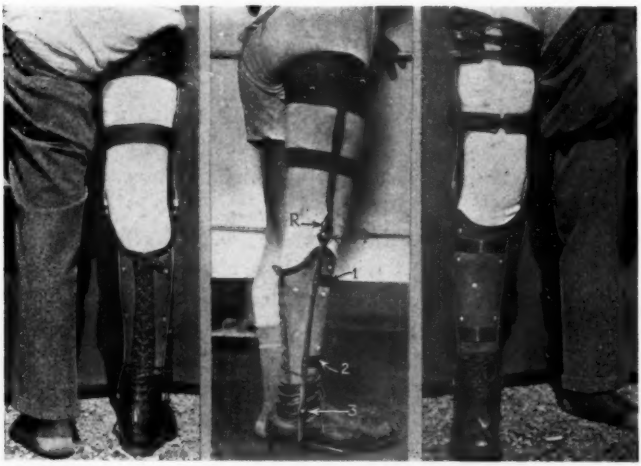

Fig. 191.—Back view of splint, showing lacing down the back of the puttee and eyelets and lacing down the back of the shoe, where the back seam of the shoe has been opened. Side view of the splint, showing how the weight is carried from the leather cuff, which fits snugly up against the tuberosity of the ischium, from the ischial tuberosity on the vertical bars to the heel: 1 is the upper broad metal band which surrounds the head of the tibia and fibula; 2 is the lower metal band; 3 is the hinge-joint which fastens the vertical bar to the metal foot-piece; 4 is the hinge-joint connecting the upper end of the lower lateral metal bar with the upper vertical lateral bar; *R* is the metal ring. In this photograph the ring is down in place, so that the upper and lower bars are locked. In Fig. 192 the ring is drawn upward, unlocking the lateral bars, so that the knee can be bent. Front view of the splint, showing lacing of upper leather cuff and contour of front of the puttee.

These upper joints are so constructed that the joints can be locked by two metal rings (Fig. 191, *R* and 4). If these rings are drawn upward the knee-joint can be bent when the patient sits down (Fig. 192). When the patient stands these rings fall and hold the hinge-joints locked at the knee, and

weight bearing is carried from the ischial tuberosity on the vertical bars to the heel.

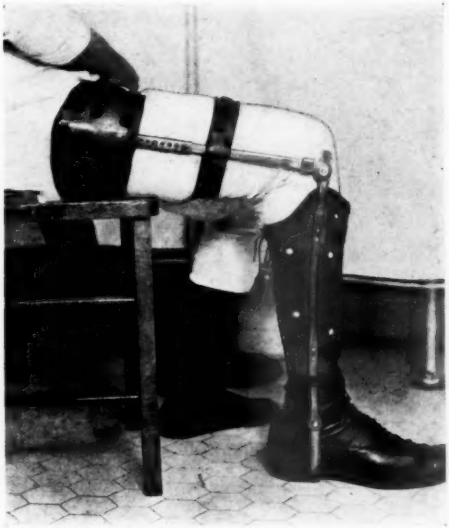

Fig. 192.

Fig. 193.

In order to get the patient's foot into the shoe, when the brace is applied, it is necessary to have the back seam of the

shoe opened and fitted with eyes and laces so as to close the opening when the shoe is applied (Fig. 191).

Later, when union has progressed and is more firm, the upper portion of the appliance can be removed and the lower part alone worn (Fig. 193).

The appliance has proved efficient, comfortable, and satisfactory in every way.

PORTABLE APPARATUS FOR TRACTION ON SKIN IN ARM AMPUTATIONS

In guillotine amputations of the arm it is extremely important to preserve as much length as possible of the humerus and to prevent retraction upward of the soft parts, which is the natural tendency, as this is the chief danger to future function. If no precautions are taken, the divided muscles retract and at the end of three to four days the skin margin will already have been drawn upward some distance beyond the end of the bone stump, and the end of the stump will already be definitely conical. If this process is allowed to go on untreated, by the end of two weeks the soft parts will have become so markedly retracted that the end of the bone will be uncovered for a distance of perhaps 2 or 3 inches, the muscles will form a thin conical mass, and the skin edge will have retracted perhaps 4 or 5 inches above the end of the bone stump. If thus allowed to continue a secondary amputation high up will be needed to cover the bone, many inches of which will have to be sacrificed, thus producing a short stump and one of far less functional value.

This has long been known, and traction by means of adhesive plaster strips placed on the skin and drawn downward by strings attached to pulley and weight extension has been used to prevent this retraction. As a rule, four broad strips of zinc oxid adhesive plaster are employed, and these are fixed to the skin parallel to the long axis of the stump, one in front, one behind, and one on each side of the arm, from a point about 2 inches proximal to the end of the stump, and extending upward as high as the shoulder. The strips are long enough to extend distalward well below the end of the stump, and here they are attached to a spreader of wood or metal of sufficient size to keep the strips from contact with the open wound and allow room for a properly large dressing for the end of the stump, and Carrel-Dakin treatment.

Probably the best device for obtaining continuous traction by means of weights and pulleys is that suggested by C. W. G. Bryan. This is described and illustrated in the Journal of the Royal Army Medical Corps, May, 1916, and later published in the Military Surgeon, vol. xlii, No. 2, February, 1918, p. 162. Bryan attaches the four adhesive plaster strips to a round metal ring and secures traction by means of three ropes and three pulleys which are suspended from the upper longitudinal bar of a Balkan frame.

As guillotine amputation is performed only when severe infection demands it, and where the formation of flaps or any attempt at primary closure of the wound would be dangerous, a second operation is ordinarily done to close the end of the stump. The end of the bone, due to drying from exposure to the air and to infection, frequently forms a sequestrum. It is important not to be too hasty with this second operation. When necrosis is present the second operation should not be performed until after the sequestrum has separated. This can be judged by roentgenologic examination and inspection. It is important, too, that the second operation be postponed until all edema has disappeared from the stump. Presence of edema indicates presence of infection, and as these tissues must be divided in the second operation, if they are infected, the infection will be spread. Time is required before the sequestrum separates and edema disappears, and thus the importance of some portable means of skin traction is obvious.

During the World War the British secured skin traction in the lower limb by means of a splint consisting of a Thomas ring with side bars ending in a square frame which projected beyond the end of the stump. A modification of this appliance, adapted from Sinclair, was first published in the Military Surgeon, and later was distributed to surgeons in active duty, through the medium of Review of War Surgery and Medicine, August, 1918, p. 42, prepared in the Office of the Surgeon-General, Washington. This device is now in general use in civil surgery when guillotine amputation of the thigh is done.

While all surgeons condemn guillotine amputation except

when absolutely necessary, and this is rarely the case in civil surgery, it is definitely a life-saving measure in certain cases of violent infection and of gas gangrene. In such cases it is the most rapid method, gives the freest drainage, and saves tissue for subsequent closure, which by any other type of amputation it would be impossible to save.

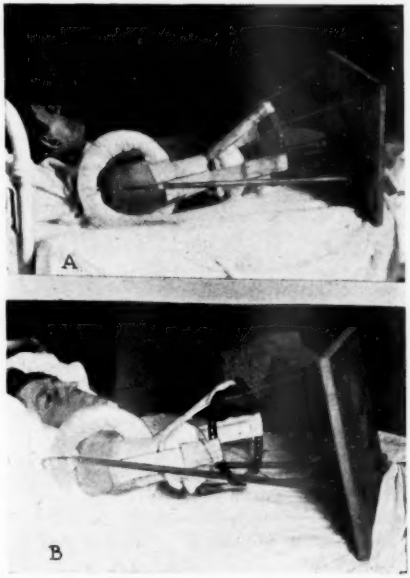

Fig. 194.—In these photographs the tongue blades, described in the text, were left off so as not to complicate the picture of the basic construction of the apparatus. See text for explanation of the purpose and technic of using the tongue blades, which are employed on the principle of a Spanish windlass, to regulate the degree of traction exerted.

Recently a severely lacerated and infected injury of the forearm came under my care late, and it was imperative to perform a guillotine amputation of the arm as a life-saving measure. In order to accomplish skin traction I devised the following apparatus which I had constructed in our hospital workshop from materials at hand in the hospital.

A Jones arm splint was made use of, cutting away all except

the shoulder ring and part of the two lateral bars (Fig. 194). Two pieces of small-caliber gas pipe were slipped over and soldered to the two lateral bars to give adequate length and strength to securely fasten a large square piece of $\frac{7}{8}$ inch lumber well distal to the end of the stump, for anchoring the traction cords (Fig. 195). Ordinary screw eyes were screwed into this square, one at each corner, for attachment of the cords (Fig. 194). A spreader was improvised from a piece of band-iron with a series of holes along its center (Fig. 195). This was bent to form a ring sufficiently large in diameter to hold the adhesive

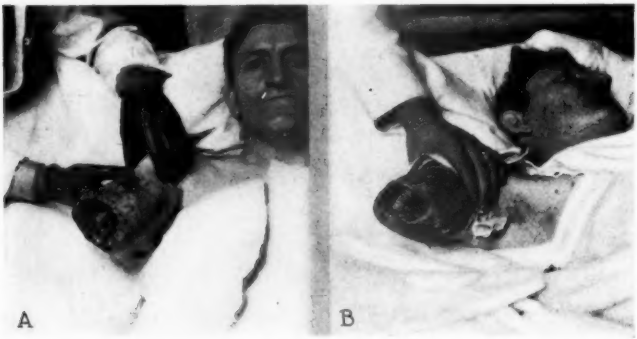

Fig. 195.—*A*, Patient referred to in text, shortly after amputation was performed and before skin traction was instituted. Note how bone stump protrudes. The muscles already show a tendency to retraction. *B*, Appearance of the stump after skin traction had been secured and maintained for some days by means of the appliance described. Note how its soft parts have been drawn down so that the stump is almost completely covered.

plaster strips away from the open wound and to easily allow the inclusion of an adequate dressing. After the four strips of adhesive plaster had been applied to the arm in the usual manner, and reinforced by a piece placed circularly around the arm, over them, the distal ends were fastened to the spreader by turning the free ends of the adhesive around the inner aspect of the ring, and then doubling them back over the ring and fastening them by means of safety-pins to the proximal portion of the adhesive strips (Fig. 194). Four pieces of heavy cord were next

used to fasten the spreader to the traction board. Each of these was used double, fastening one end to one of the screw eyes, carrying the cord up to the spreader, where it was passed through one of the holes in the iron ring, and then carrying it back and, after drawing it taut, tying it to the short end of the original tie. After all four cords were properly placed and tied, additional traction and countertraction was obtained by twisting each of the double cords. This was accomplished in the case of each of the four double cords as follows: An ordinary wooden tongue blade was inserted between the two strings, holding the blade almost parallel to the direction of the cord and then rotating the tongue blade so as to twist the two strings as a Spanish windlass. When adequate shortening was accomplished to press the ring firmly up in the axilla, care being taken not to have any pressure on the axillary vessels, this tongue blade was now turned so as to lie at right angles to the cord, and by so doing the blade was prevented from untwisting by the fact that its two ends came to lie against the two adjacent cords which held it firmly. In this manner each of the four cords could easily be shortened to the proper tension length (Fig. 195). From day to day this adjustment could be easily altered as needed. Also, whenever it was desired to remove all the dressings, these blades were untwisted and removed, and safety-pins in the adhesive strips where these were attached to the iron ring were removed and the four adhesive strips were turned backward, toward the shoulder, well out of the way of the wound, and the ring was drawn downward to the board at the end of the appliance. In order to make the appliance still lighter the metal board can be replaced by a hollow square made of metal.

Due to the square shape of the board the appliance could be easily rested on the bed when the patient was lying down, or could be rested on a chair beside the bed, whichever was most comfortable. Later, when the patient was able to be up out of bed, the apparatus was not found to be cumbersome.

The device is easy to construct, inexpensive, requires only what can be found in any hospital, and has proved to be comfortable and efficient.

CLINIC OF DR. PAUL OLIVER

COOK COUNTY HOSPITAL

CARCINOMA OF THE BREAST

Case I.—This patient, a housewife, thirty-nine years old, comes to the hospital because of a lump in the left breast with skin nodules in the vicinity. She states that about one year ago she noticed accidentally a lump in the left breast about the size of a walnut. She consulted a doctor, who gave her internal medicine and advised observation. According to her story, the lump remained about the same size until three months ago, when she noticed a "pimple" in the skin over the tumor. This and the breast tumor have grown rapidly since that time. Two other skin nodules have appeared lately. There has been no pain or discomfort. There is no history of traumatism or previous disease of the breast. She is the mother of two living children, the youngest five years, and both were nursed. As far as she knows no one in her family has had cancer. Her general health has been good except for a cough and some dyspnea which have come on recently.

Examination shows a fleshy young woman of healthful appearance. Apparently there is some dyspnea and she is running a temperature of about 100° F.

Both breasts are large, flabby, and pendulous. The left is larger and more prominent, especially the axillary half. The nipple is neither raised nor puckered. Opposite the left nipple and toward the axillary margin of the breast is a raised area the size of a half dollar denuded of skin and covered by a yellow crust. In the vicinity are ten or more red nodules in the skin varying in size from pinhead to pea; some are separate, others grouped. A few of the larger nodules have a crust on the top

indicating a beginning ulceration. The skin over the axillary half of the breast is puckered, is somewhat edematous, and has a pigskin appearance.

On palpation we find that the central axillary part of the breast is occupied by a firm irregular mass about the size of an orange, attached to the skin at the crusted area and fixed in the breast tissue, but movable over the underlying muscles. The breast tumor and nodules are hard. The left axilla con-

Fig. 196.—Case I. Showing skin nodules about denuded area. Nipple not shown.

tains two nodular masses of lymph-nodes which are hard, rounded, and fixed to the axillary structures. The right breast and axilla and supraclavicular spaces are free of palpable nodules.

Examination of the chest shows a few râles at the bases of the lungs, but no signs of consolidation. *x*-Ray examination of the chest was negative for metastases. Abdominal examination is negative.

There can be no doubt of the diagnosis in this case. We have all of the findings of a well-advanced carcinoma and one that is inoperable.

It is difficult to know whether the life of the patient would be prolonged by a radical removal or whether it is better to treat the case with *x*-ray and radium. In my limited experience, similar cases when subjected to operation, promptly recur and progress in a few months to a fatal termination. Some benefit may be expected from the proper use of *x*-ray and radium, and the patient will be spared the ordeal, risk, and after discomfort which go with the radical operation.

Case II.—This young woman, a housewife, nineteen years of age, comes here because of a lump in each breast. One year ago she was operated upon for salpingitis, and states that both breasts contained numerous nodules at that time. She attributed them to normal salt solution injected beneath the breasts. These nodules disappeared in a short time. About one month later she discovered a small nodule in the right breast which has grown steadily larger during the past eleven months. She further states that it varies in size, getting larger, and somewhat tender after working steadily. Rest reduces the size and relieves the tenderness. No change has been observed at the menstrual periods.

About one month ago she noticed a small nodule in the left breast with similar characteristics. There is no pain.

She has been married one and a half years and has not been pregnant. The menstrual periods are regular.

The patient is of healthful appearance. The breasts are of about equal normal size and contour. There are no visible nodules in the sitting position, but on lying down a prominence is noted at the upper inner margin of the right areola. On flat hand palpation a definite tumor mass is made out in the upper inner quadrant of the right breast just outside the areola. It is about the size of an olive, irregular, nodular, and quite firm. It is freely movable in the breast tissue and not attached to the skin. A nodule the size of a large pea with similar charac-

teristics is present in the left breast at the outer, upper margin of the gland tissue. No other definite nodules can be made out in either breast. There are several palpable lymph-nodes in each axilla the size of a split pea, a little larger on the right. They are flat, soft, and not tender. A right epitrochlear gland is also palpable.

The early age of the patient, the history of onset with multiple nodules, a freely movable definite tumor in either breast, and the small flat axillary lymph-nodes stamp this condition as benign. The question then arises whether we are dealing with the remains of a chronic inflammatory process or a true new growth—whether these are cysts or true fibro-adenomas. The history of multiple nodules in both breasts at the onset, the enlargement and tenderness of the present tumors brought on by overuse of the arms and the bilateral axillary nodes, would speak for a chronic cystic mastitis. The youth of the patient and the apparent normal condition of other parts of the breasts argue against such a condition. Cystic mastitis occurs commonly in the breasts of women of middle age which have lactated and not been nursed. The condition is painful, progressive, and apt to be more tender at menstrual periods. Although these tumors exhibit the characteristics of fibro-adenomas, it is unusual to have lymph-gland enlargement and variation in size associated. According to some authorities true fibro-adenomas may develop on a cystic mastitis. The lymph-nodes may be due to another cause.

These tumors will be removed, for they show a tendency to grow, and it is not possible to say that they may not become malignant.

Note.—On removal they proved to be fibro-adenomas.

Case III.—The next patient is a married woman, thirty-three years old, who first noticed a lump in the right breast twelve years ago, after the birth of her first child. It was a nodule about the size of the tip of the finger and remained so until a few months ago, when it began to grow gradually larger.

There has been no pain or tenderness at any time and no history of trauma or previous breast disease. There is no enlargement at menstrual periods or on exercise.

This is a well-nourished woman. The breasts are equal in size and of normal contour. When lying down a smooth, small swelling is apparent in the right breast just above the margin of the areola. In the erect position it is not visible. To palpation there is a firm, but somewhat elastic mass, just beneath the skin and adjacent to the areola about 3 cm. in diameter. It is irregular in outline, somewhat flattened, freely movable in the breast tissue, and not attached to the skin. The remainder of the right breast and the left breast are normal. One firm rounded lymph-gland, the size of a navy bean, can be felt in the right axilla.

This tumor has all the earmarks of a benign growth, either a fibro-adenoma or a solitary cyst. Because of the flattened contour the former is more likely. The enlarged axillary node is not supposed to go with fibro-adenoma and may be due to chronic irritation from the upper extremity. It should be removed because of the recent tendency to grow, the possibility that it may develop into a malignant growth, either carcinoma or sarcoma, and also to relieve the patient's mind.

Case IV.—The next case demonstrates the course which many of these breast carcinomas pursue. This is a colored woman, thirty-one years old, who first entered this hospital nine months ago because of a tumor growth of the right breast. She had first noticed a lump in the breast four months previously. It steadily increased in size, and two weeks before coming to the hospital, broke through the skin and grew rapidly. There was no history of trauma. She had nursed 2 normal children. At that time (nine months ago) she was well nourished and her general health unimpaired. There was present in the upper outer quadrant of the right breast near the nipple an ulcerated area the size of a silver dollar, connected with a hard tumor mass in the breast tissue beneath. There were several hard glands in the right axilla.

A radical operation was performed by a competent surgeon. The pathologist reported the tumor to be an alveolar carcinoma. There was suppuration of the wound and complete healing did not result.

She returned to the hospital in seven months and was shown in this clinic with a fungating, foul-smelling tumor growth of the right chest wall the size of a grapefruit. This was partly excised with a diathermy needle. The remainder of the mass sloughed off. She has been confined to bed for the past two months, growing gradually weaker. At present she is unable to sit up and is able to take only liquids. She is quite markedly emaciated and somewhat dyspneic, and it is apparent that the end is not far distant.

There is a flat granulating surface of the right chest wall, 6 inches in diameter, showing several yellow areas of necrotic tissue. At the inner end of the incision is a firm nodule beneath the skin, the size of a walnut, which is growing rapidly. There are a few hard lymph-nodes in the left axilla. On account of the patient's condition further examination has not been attempted, although we suspect the mediastinum and lung to be involved.

During a three-year period in 1921, 1922, and 1923, there entered this hospital 110 cases of cancer of the breast, 108 of which were women and 2 men. Twenty-one were colored women. Twenty-two had been operated upon elsewhere and entered here because of recurrence. This leaves 88 who came in for initial treatment.

These were divided into groups as follows:

First, those patently inoperable on account of ulceration or skin nodules, involvement of supraclavicular lymph-nodes, fixed glands in the axilla, or metastases in bones or other organs. There were 24, or 27 per cent., in this group.

Second, there were cases in which the disease was considered removable, but the hope of cure was small. There were 26 of these.

In a third group of 19 cases there was a removable tumor with involvement of axillary glands demonstrated at operation,

and a fourth group, of 11 cases, in which there was no demonstrable lymph-gland involvement.

In reviewing these cases it was found that the youngest patient was twenty-five years, and the oldest eighty-three years of age. Sixty-five were between thirty and sixty.

The onset in 57 was with a lump and with pain in 7. This would seem to indicate that pain is not an early manifestation of cancer of the breast.

The duration of the disease, as stated by the patient, was six months to one year in 35 cases, two years in 13, and four to ten years in 8.

Trauma was stated as causative in 15, 2 of which were men. Careful questioning on this point often eliminates this probability. Those who had nursed children were 42, those who had not, 22. This indicates that lactation does not predispose to cancer.

Discharge from the nipple was present in 11, 4 showing a bloody discharge. Other reports state that a nipple discharge is no aid in the differentiation between a benign and malignant lesion of the breast. It occurs with equal if not greater frequency in benign conditions.

A history of previous breast disease, such as lactation mastitis, was obtained in only 4 cases.

In making the diagnosis of a breast tumor it is first necessary to determine the presence of a definite tumor. Women often present themselves stating that a tumor is present, when there is only a marked lobulation evident on picking up the breast tissue between thumb and fingers. This is found especially in small breasts which have lactated and undergone incomplete involution. In such cases all sense of a nodule disappears when the breast tissue is pressed against the chest wall by the flat of the fingers. A true nodule will be readily felt by this flat-hand palpation. Having determined the presence of a definite tumor, it is then necessary to examine its characteristics. A carcinoma is hard, fixed in the mammary gland tissue, and, shows early attachment to the skin, evidenced by a dimpling on pushing or raising the skin. The common small fibro-adenomas and tense

cysts are freely movable in the breast tissue and give a sense of elasticity. Prominence of the tumor on inspection should not be given as a differential sign, for it occurs in small breasts in benign as well as malignant growths, with the patient in the recumbent position. Multiple nodules indicate a benign condition.

It is impossible at times to distinguish a tense cyst embedded in the breast tissue from an early carcinoma.

Localized chronic inflammation, such as that remaining after a mild lactation mastitis, tuberculosis, or gumma, may give the same local findings as a carcinoma. The inflammatory lesion is of shorter duration and often tender.

Enlarged lymph-nodes may be due to an inflammatory process or benign tumor. The carcinomatous gland, however, is hard and rounded, the inflammatory gland softer, more flat, and apt to be tender.

It should not be forgotten that there are rarer forms of breast cancer which differ clinically from the usual familiar type. There is an acute carcinosis which occurs in the breast of the pregnant woman which simulates an acute mastitis, is very virulent, and rapidly fatal. Another type is that which produces a diffuse infiltration of the entire mammary gland without a definite tumor mass palpable, although there is usually one present. The skin is red and edematous, and shows the "pigskin" appearance. The lymph-nodes are involved early. It simulates an inflammatory condition and usually occurs in large fatty breasts of women at the cancer age.

A third type is the cystadenocarcinoma which causes an enlargement of the breast, is slow growing, but finally exhibits all the signs of malignancy, and is liable to break through the skin and fungate.

It is also well to remember that aberrant or sequestered bits of mammary gland at the anterior margin of the axilla or below the breast toward the sternum may be the seat of carcinoma and have no direct connection with the gland proper.

Examples of these types were present among this small series of cases.

In case a single tumor is present we come to our method of procedure. No matter how skilled one may become in the differential diagnosis of breast cancer, there always remains a doubt if an existing tumor does not exhibit the typical signs of cancer. If the typical signs are present with enlarged lymph-nodes, the patient is already one of a group in which a cure may be expected in 5 to 10 per cent. after radical operation.

Very early cancer gives the signs of a benign tumor. If this is true, it would seem that the only safe procedure is the removal of all breast tumors. It is better not to wait in order to see whether it grows and develops signs of malignancy. Certainly all doubtful tumors should be excised with an area of breast tissue and submitted to gross and microscopic examination.

If carcinoma, the gross section is usually typical and determining. The cut surface is grayish white, opaque, depressed below the level of surrounding tissue. It shows projections radiating into the fat, and yellow or chalky-white streaks or dots in the opaque mass which occur only in carcinoma, according to Ewing. Scraping the cut surface yields a milky fluid containing minute white particles—the so-called cancer juice. There is a sense of brittleness and grating on cutting through the tumor tissue. Unless these typical features are present, there is doubt, and a microscopic section is necessary. A cyst with thickened wall or projecting mass at one point and chronic inflammatory tissue require usually microscopic examination to rule out carcinoma.

In this series of 88 cases, 46 radical and 10 palliative operations were performed. As careful a follow-up as is possible with this class of patient was attempted, with the result that only a few were found living after three years. This poor showing is probably partly due to the advanced stage of the disease and to the poor general resistance of many of these patients on entrance to the hospital.

CLINIC OF DR. ROBERT H. HERBST

PRESBYTERIAN HOSPITAL

BILATERAL PYONEPHROSIS. OBSTRUCTION AT URETEROPELVIC JUNCTION

A WOMAN aged sixty-eight, on admission to the hospital, stated that she had had several intermittent attacks of chills and fever during the last two years. These attacks were associated with frequent, imperative, painful urination. The present one which began two weeks ago was more severe and started with nausea and vomiting and severe pain in both flanks, more marked on the left side.

On examination the left kidney was found enlarged and tender, the right somewhat enlarged and not so tender.

The catheterized specimen of urine was crowded with pus, and on analysis showed: cell count 1650, acid reaction, albumen 2 mm., no sugar. The blood-count showed 17,000 leukocytes, 3,900,000 reds, hemoglobin 60 per cent.

The temperature varied from 99.8° F. in the morning to 104.2° F. in the evening.

Blood chemistry: Non-protein nitrogen, 53 mg.; urea, 31 mg.; creatinin, 3 mg.; uric acid, 3.6 mg.

A plain film taken of the urinary tract showed a rather large kidney outline on the left side, and a somewhat enlarged outline on the right. No stone shadows were seen and the films were otherwise negative.

Cystoscopic examination revealed a marked injection of the bladder wall (cystitis three plus). The ureters were catheterized, each taking a No. 6 shadowgraph catheter, which, however, hesitated on each side just before entering the kidney pelvis. Very thick cloudy urine drained from each kidney. Phthalein,

injected intravenously, appeared on the left side in fifteen minutes, on the right in nine minutes. Sixteen per cent. of the dye was excreted from the left kidney in three hours, 22 per cent. from the right kidney.

Within a few hours after the cystoscopy and drainage of the kidney pelves the temperature dropped and remained low for

Fig. 197.—Pyelogram of right kidney showing dilatation of the kidney pelvis.

several days, then began to rise again. At this time another cystoscopy was done, the renal pelves drained, and a pyelogram of the left kidney made. This pyelogram showed a marked dilatation of the left pelvis. A few days later cystoscopy was again repeated and a pyelogram of the right kidney made.

This also showed a dilatation of the pelvis, but not as marked as on the left side.

The cell count of the urine from the left kidney showed 1998 cells, while that from the right showed 860 cells. The cultures of these urines all showed a Gram-negative rod (Bacillus coli).

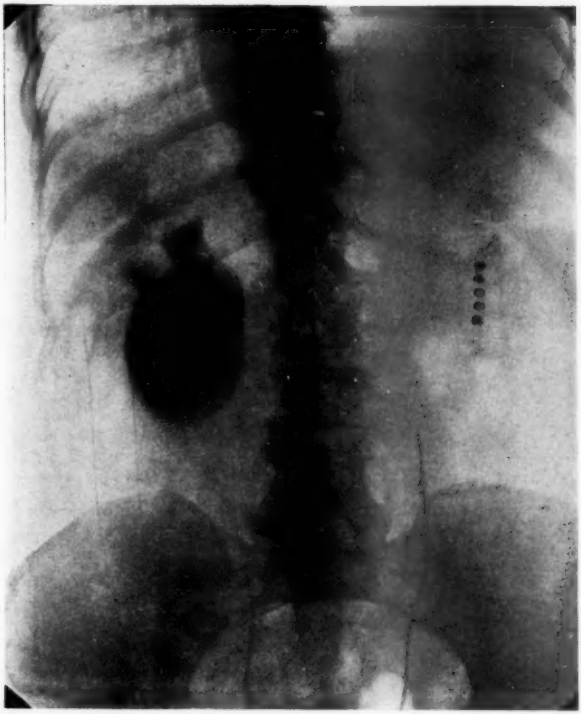

Fig. 198.—Pyelogram of left kidney showing marked dilatation of the kidney pelvis.

Comment.—From the above history and findings it is evident that this woman has a bilateral pyonephrosis.

The earlier attacks were probably simple pyelitis, which, in turn, caused a narrowing of the ureteropelvic junction with retention and dilatation of the renal pelves.

The exact cause of this type of pyonephrosis is not always clear. Whether the obstruction at the ureteropelvic junction is the primary cause of the pyelitis, or whether the infection in the renal pelvis causes a thickening and swelling at its outlet, is often difficult to say.

This old lady was treated by drainage of the renal pelves with "in-lying" catheters. The catheters were left in place from twelve hours to several days and the pelves lavaged with boric acid solution every six hours. She was given a milk and cereal diet with forced fluids, and urotropin and acid sodium phosphate. After sixteen days her temperature remained normal and the urine was clear. Three months later her phthalein output showed 23 per cent. on the left side in two hours and 27 per cent. on the right side.

Occasional dilatation of the ureteropelvic junction with pelvic lavage will, in all probability, prevent a recurrence in this case.

Conservative treatment of such cases of pyonephrosis with "in-lying" catheters is often followed by good results with improved renal function, providing the destruction of kidney parenchyma has not gone too far. Plastic operations on the ureteropelvic junction are not very satisfactory, and nephrectomy should be done in cases where recovery of renal function is not possible, and the other kidney is capable of carrying on the work.

TUMOR OF KIDNEY. HYPERNEPHROMA

A MAN aged sixty-four gave a history of attacks of intermittent hematuria. These attacks began about one year ago and lasted from several days to a week. They were not associated with pain and the act of urination was quite normal. He

Fig. 199.—Pyelogram of tumor of kidney showing peculiar distortion of pelvis.

did not complain of any other symptoms except weakness and some loss of weight (10 pounds), which he thought was caused by loss of blood.

Examination.—The prostate gland was normal in size and

consistency. Although he is a large fleshy man, a mass was palpable in the left flank and upper left abdomen. This mass moved with respiration. There was a large left varicocele present. The physical examination was otherwise negative.

Every specimen of urine was well stained with blood. The urinalysis showed 500 red blood-cells and 30 white blood-cells per cubic millimeter, no casts, no sugar, albumen present, probably due to the blood.

Blood-pressure 186/88. Wassermann negative. Leukocytes 8700, hemoglobin 82 per cent. Temperature and pulse were normal.

Blood chemistry: Urea, 13.6 per 100 c.c.; uric acid, 4.3 per 100 c.c.; creatinin, 1.5 per 100 c.c.; carbon dioxid, 63.6 vol. per cent.

The plain film of the urinary tract showed a normal outline of the right kidney, but the left could not be made out.

Cystoscopic examination revealed a normal bladder. On observing the ureteral orifices, blood-stained urine could be seen discharging from the left side, clear urine from the right.

The ureters were catheterized, and each took a No. 6 shadowgraph catheter to the kidney. Bloody urine drained from the left side, clear urine from the right.

The examination of the segregated urines showed:

Cell count: Right kidney, 0; left kidney, 50; many red blood-cells.

Cultures of all urines were negative.

Phthalein test: Right kidney, appeared in three minutes; 22 per cent. in thirty minutes. Left kidney, appeared in five minutes; 16 per cent. in thirty minutes.

Pyelogram: Right pyelogram shows the kidney pelvis at the second lumbar vertebra. The pelvis was large, but could be considered within normal limits for the size of the patient. Left pyelogram showed a peculiar square pelvis with unusual calices, two pointing downward and one outward. The top of the pelvis ended abruptly as a rather jagged edge. The entire pyelogram was further outward from the midline than the usual position. The *x*-ray film of the chest was negative.

Tumor of the kidney was diagnosed in this case, and, as we were not able to demonstrate metastases, a nephrectomy was performed, the perirenal fat being removed with the kidney.

Comment.—The diagnosis of tumor of the kidney is not always easy. Although the cardinal symptoms of tumor of the kidney are hematuria, pain, and tumor, one or more of these signs is often absent. However, the presence of blood in the urine always deserves a thorough investigation both as to the location of bleeding and the pathology responsible for it. Most of the lesions of the urogenital tract which cause hematuria are serious and, if investigated when the blood is first seen, an early diagnosis will be made and much benefit derived therefrom.

Pyelography is of great assistance in making the diagnosis of renal tumor. Early in the growth of neoplasms the tumor invades or compresses the pelvis and calices, producing marked changes in the outline of the pyelogram. These changes are often quite characteristic, the growth of the tumor causing a narrowing and lengthening of the calices, producing the so-called spider-leg deformity. However, the change in the contour of the pelvis may produce many peculiar forms, making interpretation difficult. In this case the tumor involved only the upper third of the kidney, obliterating the upper calices, and crowded down on the pelvis, producing a square-shaped pelvis with odd-shaped calices projecting downward and outward from it.

A pyelogram of the normal side is often helpful in interpreting the changes in the involved kidney.

Varicocele when present in this type of case, especially on the right side, is often of diagnostic importance in retroperitoneal and intra-abdominal tumor, in the vicinity of the renal or spermatic veins, exerting pressure symptoms. It is a sign at times seen in tumor of the kidney.

In performing nephrectomy for malignant tumors of the kidney the perirenal fat should be removed with the kidney, and as much of the pedicle as possible should also be taken along. *x*-Ray treatments should supplement nephrectomy, and, if accurately carried out, may delay and sometimes prevent recurrence.

LINEAR ULCER OF THE BLADDER

A YOUNG woman aged twenty-one had always enjoyed good health until eight months before she was admitted to the hospital. At this time, following an attack which was diagnosed as influenza, she developed frequent imperative painful urination. At times the urgency was so severe that it caused a slight incontinence. The number of urinations varied from 10 to 25

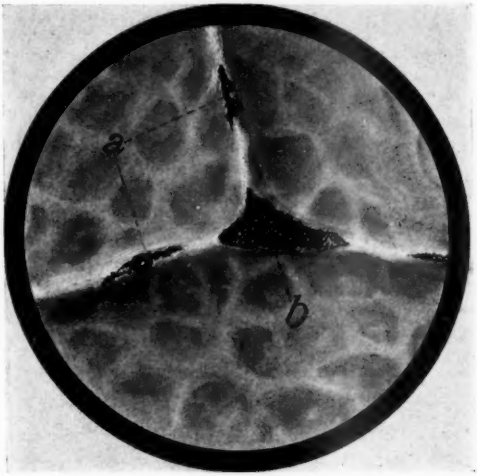

Fig. 200.—Drawing of the cystoscopic appearance of linear ulcer, *a*, droplets of blood appearing in ulcer; *b*, edges of ulcer have spread apart.

in twenty-four hours. Dysuria was often very severe, the pain continuing for one-half hour or more after urination. During the more severe attacks she thought the urine was slightly blood stained. Although she believed that she had lost about 20 pounds during the eight months of illness, she appeared well developed and not acutely ill.

Examination.—The general physical examination was nega-

tive. Her menstrual history was normal and examination of her pelvis was negative. The urinalysis showed 30 white blood-cells with many red cells per cubic millimeter, no casts, sugar, or albumen present.

The blood-pressure was 118/60, blood-count 4,200,000 red cells; 9050 white cells, and hemoglobin 80. Wassermann negative.

Cystoscopic Examination.—The bladder was injected throughout, cystitis two plus. An irregular long, narrow defect (ulcer) was seen on the posterior wall of the vertex of the bladder. As the bladder was distended with water, small droplets of blood were seen to appear along this ulcer. The bladder was more injected in the region of the ulcer. The bladder capacity was greatly reduced and the patient complained severely with less than 2 ounces of distention fluid. The ureteral orifices appeared normal. These were catheterized and the urines collected for study. The findings were as follows:

	Bladder.	Right kidney.	Left kidney.
Cell count	30	0	0
Smears, Gram's method	No organisms	No organisms	No organisms
Culture	No growth	No growth	No growth

On account of the appearance of the bladder, urines obtained from both kidneys were examined in direct smears (Ziehl-Nielsen) for tubercle bacilli, but none were found. Two sets of guinea-pigs were inoculated with urine from each kidney and bladder, but were all found negative at autopsy.

Direct smears from six different specimens of bladder urine taken on successive days, all failed to show acid-fast bacilli.

Pyelograms made of both kidneys showed normal renal pelves on both sides.

She did not have any temperature. This was taken every four hours during a period of two weeks.

Comment.—The age and history in this case would lead one to suspect tuberculosis, but the repeated negative urine findings of both the upper urinary tract and bladder, coupled with the cystoscopic picture, made linear ulcer of the bladder the most probable diagnosis.

Little is known about the etiology of these ulcers. Some believe them to be caused by a trophic disturbance, focal infection, toxemias, infections extending from the upper urinary tract, or by direct extension from the cervix or uterus. However, in most of these cases no definite etiologic factor can be determined. The urine is usually clear and sterile and the only abnormal finding in the urine is red blood-cells which evidently come from the ulcer when the bladder is distended. These ulcers are usually located high up on the posterior wall of the bladder, well away from the ureteral orifices, while ulcers caused by tuberculosis and other infections of the upper urinary tract are usually found near the ureteral orifices. They are from 1 to 3 cm. in length, 1 to 2 mm. in width, and look like a "cracked lip" when it is spread sufficiently to cause bleeding. At times these ulcers are found on the summit of a ridge produced by a scar from a previous healed ulcer. They are more common in women than in men and may occur at any age.

Linear ulcers are not directly dangerous to life, but undermine the general health by the constant pain and urgent frequency.

Bladder lavage, instillations, and drainage are of little value in the treatment of these ulcers. Resection of the involved area of the bladder wall may result in cure. Destruction of the base of the ulcer with the high-frequency electrode has given the best results in our cases. Recurrences occur in a fair proportion, and the use of a high-frequency electrode through a cystoscope gives one an opportunity to destroy these ulcers as they reappear.

A CASE OF DOUBLE RIGHT KIDNEY, DOUBLE URETER, ONE ENDING BLINDLY. CALCULUS PYONEPHROSIS OF UPPER PELVIS

A WOMAN aged thirty-five came to the hospital complaining of pain in the back, more marked in the region of the right flank, frequent urination, and dysuria. She also complained of a sensation of fulness in the bladder, and felt that she did not completely empty her bladder at each act of micturition. These symptoms had been present for the last seven years.

Fig. 201.—Pyelogram of double kidney with blind ureter from upper pelvis ending in a ureterocele. Only lower pelvis injected.

Examination.—The right kidney was easily palpated and appeared to be enlarged. There was also some tenderness on deep palpation in the right flank. The physical examination was otherwise negative.

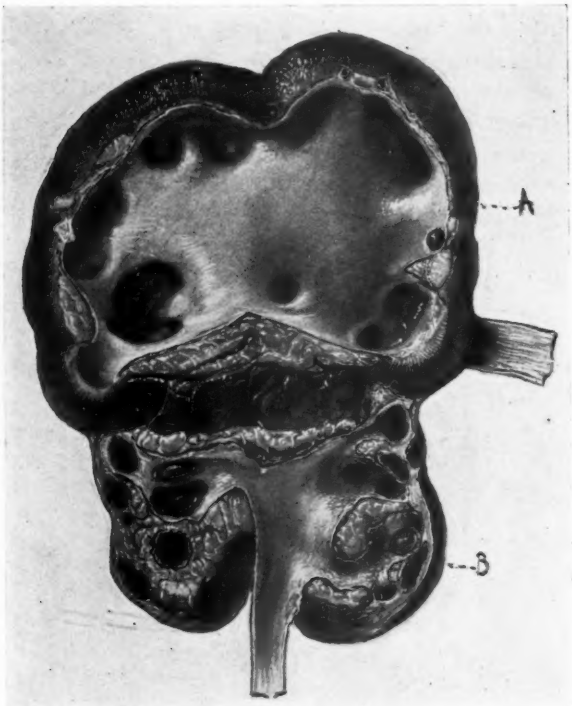

Fig. 202.—Drawing of specimen of double kidney described in Case IV: *A*, Upper pelvis dilated, with dilated ureter. *B*, Lower pelves with normal size ureter.

Urine: Alkaline, no sugar, albumen present one plus, 240 white blood-cells per cubic millimeter, numerous epithelial cells, no casts. Blood: White blood-cells 7500, hemoglobin 88, blood-pressure 129/78, Wassermann negative.

Blood chemistry: Urea 9.4, uric acid 3.9, creatinin 1.2, total non-protein nitrogen 25.3, carbon dioxid 51.3.

The plain *x*-ray film of the urinary tract showed the outline of the right kidney to be rather large and contained two irregular densities in the upper pole, which had the appearance of stone. Film otherwise negative.

Cystoscopic examination: Bladder injected, cystitis two plus. The left ureteral orifice appeared normal, while in the region of the right orifice a bulging mass was seen with a large orifice at its upper part. This mass was about the size of a large English walnut, and changed in size and shape from time to time. This was a wave-like action. The mass was covered by mucous membrane and was evidently a ureterocele. The orifice on its upper surface was easily catheterized with a No. 6 shadowgraph catheter as was also the left ureter. Urines were collected for study and pyelograms made.

Urine findings:

	Bladder.	Right kidney.	Left kidney.
Cell count	210	60	0
Smears, Gram's method	Many gram nega. rods	No organisms	No organisms
Cultures	Salmonella group	No growth	No growth
Direct smears, tubercle bacilli, Ziehl-Nielson	No acid-fast bacilli	No acid-fast bacilli	No acid-fast bacilli
Guinea-pigs	Negative	Negative	Negative

Phthalein test:

	Right kidney.	Left kidney.
Time appeared	5 minutes	3 minutes
First half-hour	3 per cent.	18 per cent.

Pyelogram: The left pyelogram showed the kidney pelvis at the level of the first lumbar vertebra, and appeared normal. The right pyelogram showed the kidney pelvis at the level of the third lumbar vertebra. This pyelogram suggested a double kidney pelvis, the lower calices were well filled, and apparently pushed downward. There was otherwise no filling of the upper part of this kidney. The ureter was slightly dilated and peristaltic change was visible.

Comment.—The pyelographic findings helped to clear up the

bladder findings. We evidently had to deal here with a double kidney and double ureter. The ureter from the upper kidney ended blindly in the bladder, and produced the ureterocele seen on cystoscopic examination. This upper kidney was pyonephrotic due to poor drainage and contained stones. Upon exposing the kidney the upper or pyonephrotic part comprised about four-fifths of the kidney and a large dilated ureter drained this segment. The lower kidney was drained by a normal sized ureter. The phthalein collected from the right ureteral catheter must have been excreted by the lower kidney. These findings coupled with a pyonephrotic upper kidney made a clear indication for complete nephrectomy instead of heminephrectomy. This was carried out. The convalescence was uneventful. She was relieved of all of her symptoms including the sensation of fulness in the bladder after the act of micturition. The cystoscopic examination made three weeks after the nephrectomy showed that the ureterocele had entirely disappeared. This was undoubtedly produced by the blind ending of the ureter from the upper kidney.

CLINIC OF DRS. EDMUND ANDREWS AND WARNER S. BUMP

ST. LUKE'S HOSPITAL

VENTRAL HERNIA—FASCIAL TRANSPLANT

THIS patient is a colored female, forty-two years old, who had a hysterectomy performed seven years ago. Four years later a bulging mass appeared in the lower portion of the scar, which has progressively gotten larger and larger, until at present the hernia is nearly as large as the patient's head.

She is so enormously obese, weighing over 250 pounds, that the hernia does not appear very prominently when she stands, as it is buried in an enormous mass of subcutaneous fat. However, on palpation the harder mass may be very clearly outlined. On lying down the hernia reduces spontaneously as a rule, although I was unable to reduce it while she was in the erect position. After reduction palpation reveals that the ring is a very large one. It lies in the midline and extends for a distance of about 5 inches longitudinally and perhaps 3 inches transversely. I have found a great many times, however, that when one palpates the edges of these rings he is often deceived as to their size, as he has to feel through a large mass of subcutaneous fat and skin, and on operative exposure they often prove to be larger than one expects. The tissue border in the edges of the ring is very hard and appears to be very thick, and for that reason offers a fairly adequate hope of cure. This hernia occurring in the midline is more of the type of diastasis recti, and probably there was not much destruction of the fascial planes of the abdominal wall and the skin wound appears to have healed with a minimum scar formation. For that reason we have decided that this is an operable case.

The operability of such an enormous ventral hernia is often a question of grave doubt. Certainly those following sloughing and suppurating wounds, when they reach such magnitude, offer but slight chance of cure for the reason that there is such a tremendous loss of tissue that when the edges of the ring are exposed they cannot be brought together without tearing, much less overlapping, with any hope whatsoever of their holding. A good indication of the operability, in my experience, has been the thickness of the edges of the hole through which the hernia emerges. The skin can usually be deeply invaginated into such a hole and the edges carefully examined, and much valuable information gained. If they are very thin it is obvious that the muscle tissue has been destroyed, and all that we have left is thin layers of scar left over after extensive sloughing of the anterior and posterior sheaths, and such cases are generally refused operation if the hole is very large or the hernia having magnitude comparable to this.

The recurrence rate in large ventral hernias has been shown to be enormous, perhaps 40 per cent., and such operations should not be undertaken without the patient definitely understanding the probability of their failure. However, such a hernia as this brings about an almost total disability. This patient states that she has been unable to do any heavy work, has had constant pain in the abdomen, and been practically incapacitated for two years, and almost any risk is warranted. However, a good plan, perhaps, is to inform the sufferer that the operation will probably have to be done in two stages. First, a repair of all the tissue possible and strengthening the layers of the abdominal wall—all that one can do to cover the hernial opening. The result will be carefully observed for several months, and at the first signs of giving away these tissues will again be approximated and if possible overlapped, bringing about a final cure only after a second operation. The laity has become so accustomed to two-stage operations, such as the prostate, various bowel conditions, and in a great many other types of surgery, especially chest surgery, that they can well understand the necessity, and I believe that a very large share of the recurrences of

these ventral hernias if tackled surgically at an early moment will give a complete and lasting cure, whereas if they are neglected until the hernia reaches its former magnitude, operation is more hopeless than before.

Another very important consideration is the intra-abdominal pressure brought about by the enormous accumulation of the omental and mesenteric fat. It is well known that a disease of this sort occurs very largely in people suffering from extreme degrees of obesity. This woman, for example, had a simple clean operation which apparently healed normally, nevertheless, giving rise much later on to this enormous hernia due more to the accumulation of intra-abdominal fat than to faulty healing. For that reason a preparatory course of dietary treatment is of great value. The loss of 30 to 50 pounds may be safely brought about in such individuals by restriction of diet, and it is astonishing to note the greater laxity of the abdominal walls under such circumstances, but of even more importance, however, is the postoperative management. The diet must be continued rigidly for many years and the loss of weight made permanent, and the patient should be given to understand distinctly before the operation that unless these measures are faithfully carried out a recurrence is almost certain.

With these points in view we will now expose this ring. Incision was made on both sides of the old scar tissue so as to remove an inch or so of the skin which is thinned out and probably will be found to be closely adherent to the hernial sac. The dissection is carried laterally down to the anterior rectus sheath on both sides of the hernia, leaving a patch of skin attached to the dome of the sac. As soon as the rectus sheaths are reached dissection is carried inward until the edges of the whole are reached and clearly outlined. The next stage of the operation is the clearing of the hernial sac from all adherent fat. I do not intend to remove this sac at all, but simply to invert it by a series of sutures into the abdomen, and for that reason I want to remove as much of the redundant tissue as possible. The separation of the patch of skin left on the top is rather difficult, and generally the hernia has made its way very close to the skin.

In this case I have torn a small hole in the sac in getting off this patch of skin and will take advantage of it to explore around inside with my finger. I found that there were no adhesions and that the sac was not multilocular to any great extent. The hole is now closed with a ligature and the sac pushed into the abdomen with a large flat ribbon-like retractor. This enables us to study more carefully the edges of the ring. They are carefully dissected free from the sac, and in this case we have very strong tissue, almost ½ inch thick, composed partly of anterior and posterior rectus sheaths, "starched" and indurated by scar tissue.

The hernia is now allowed to bulge out again. This occurs, as you see, at once as soon as the tension is removed, as the anesthesia is not very deep. It is a good plan to do these operations under light anesthesia. It may be a little more awkward for the operator at the time, but certainly if his sutures will not withstand the tension due to struggling of this sort they are of no permanent value, and the mere fact that relaxation is not complete affords us a continuous means of testing each stitch as it is inserted. With heavy chromic catgut I am now starting at cephalic end of this sac and puckering it together. The two-stitch lines are about 1½ inches apart and that much of the sac is inserted into the abdomen by this line of stitching. This first layer must be inserted very carefully, as the sac walls are thin at the top and there is considerable danger of injuring the structures within. You see now the sac is about half the size that it was before, and the same maneuver is repeated with another line of sutures, inverting it still farther, until now there is only a slight bulging. We have come down now to the portions of the sac walls which are quite adjacent to the edges of the ring, and here they are of considerable thickness and have very much value in the cure. Starting about ½ inch from the thick rectus sheaths on each side I am inverting the sac one more layer, and this material is so strong that it draws the edges of the ring together to a certain extent, leaving a gap now of only about 1½ and 5½ inches long. When this layer of sutures is completed we will now have a perfectly flush layer of per-

itoneum with the abdominal wall. There is no more bulging and the entire sac is inverted into the abdomen and held so by sutures about its neck. However, the closure has just begun. The structures of real strength, the musculo-aponeurotic borders of the ring, have not yet been touched. I am going to do that

Fig. 203.—"Shoe lacing" with fascial transplant.

by the use of a large fascial transplant. An incision is made the entire length of the thigh in its outer surface and a strip of fascia lata about 1 by 12 inches is removed. The edges of the muscles and fascia are now approximated by using this enormous fascial like a shoe lace. It is impossible to drag this strap through the tissues with a needle or anything of that sort. I am making

lace holes for it by cutting holes in this structure with a knife, and the graft is pulled through these holes exactly as one laces his shoes, making a very firm aponeurotic union of the entire edges of the separated recti. As the suture is completed (Fig. 203) they are drawn tightly upward and the two strands left over at the lower end of the wound are transfixed, while held under tension with a heavy double chromic suture, and that suture ran around them three or four times and tied tightly.

I am now going over the wound and placing a few interrupted chromic sutures at points where the approximation of the edges has not been sufficiently accurate and might allow a little peritoneum to bulge through, but the main strength of the suture depends on the enormous fascial transplant grafted in to hold these aponeurotic edges together.

The closure of the outer layers of the abdominal wall presents some difficulties. Such wounds always have an extensive secretion and some form of drainage is necessary. It has been the practice in some clinics to leave the fat and skin wide open and make a secondary suture a week or so later. However, in this case our hemostasis seemed to be better than usual, and I am going to make a fairly complete closure. I am laying a thick strip of soft-rubber tissue underneath the fat emerging at each end of the wound, and after approximating the dead spaces with a plain catgut running stitch and closing the skin with silk. I will expect a considerable discharge and the drain will be allowed to remain in place for at least a week, so as to be certain to leave a tract from which any secretions can make their way to the outside and not allow any hematoma or abscess formation in the deeper layers which would almost certainly cause a sloughing of the tightly sutured fascia and muscles.

Postoperative Note.—The patient was kept confined to bed for two and one-half weeks and left the hospital at the end of the third week with the wound completely closed, after having had a slight bloody discharge from both drain holes for most of this period.

FATAL POSTOPERATIVE ALKALOSIS

I WANT to review rapidly one other case which, although it was not studied as thoroughly as might have been, presents a number of interesting and unusual features.

Patient was a married woman of thirty-three years who entered the hospital complaining of persistent vomiting of everything that she ate. Her history dated back six months, at which time she began to have periodic attacks of epigastric distress coming on after meals. This pain was relieved by soda, food taking, and by belching. At times she eructated much gas and sour-tasting gastric contents. These facts became progressively worse, and from the time she entered the hospital on the medical service had vomited everything that was ingested. The vomitus was yellowish and bile stained, but not fecal in character. Ewald meal showed no free acidity in a total of only nine; yeast cells and many bacteria were found in the stomach contents. Blood was present in the stools and *x*-ray showed practically 100 per cent. retention. Her condition failed to improve after a few days' medical management and she was transferred to surgery, with a diagnosis of ulcer with pyloric obstruction.

The operation revealed a mass at the pylorus extending much more into the duodenum than the gastric side, which was not operable, and a gastro-enterostomy (posterior) was done in the usual manner. No difficulties were encountered and the operation was completed in about an hour, and the patient returned from the operating room with a pulse of 80 and no evidence of shock. During that day and the next the pulse did not rise above 90 nor the temperature over 99° F. There was no postoperative vomiting or even any nausea. The patient, however, was very restless and confused mentally, but no more so after operation than before. This condition had been attributed to extreme dehydration and about ten days of practically total starvation before the operation.

Retention enemas of 2 per cent. sodium bicarbonate and 5 per cent. glucose were used to combat this condition, and about twenty-four hours after operation a hypodermoclysis of 1000 c.c. of normal salt was given.

It is my custom to withold any fluids by mouth for much longer periods than this, but in this case on account of the extreme dehydration at the end of twenty-four hours (after the operation) water was given in increasing amounts and was very well tolerated, producing no nausea and vomiting. On the third day the highest temperature was 99.2° F., the pulse ran between 90 and 110. The mental confusion and restlessness continued in a more marked degree however. On this account on the fourth day water in unlimited amounts was administered by mouth and large amounts of milk and cream were added to this. At about 1 o'clock in the morning on the fifth day the pulse shot up rather rapidly to 124 and her temperature began to go up. One thousand c.c. of 5 per cent. glucose was administered intravenously and the proctoclysis and feeding and ingestion of fluids markedly increased. All during this time no nausea occurred and everything ingested seemed to pass through normally. There was no distention, in fact, the abdomen was scaphoid in appearance. No temperature had occurred up until this period and convalescence had appeared to be uneventful. When I saw the patient that morning (the fifth day postoperative) the temperature was 105° F., pulse 120, her restlessness was much increased. She was wildly irrational and constantly thrashed about the bed. The carbon dioxid combining power taken at this time showed 120 plus. It had been normal—67—just before the operation. In order to combat this large amounts of fluid were administered, dilute hydrochloric acid, minims 20, were given every hour. Two thousand c.c. of 5 per cent. sodium chlorid was injected intravenously. In spite of these measures the pulse and temperature increased very rapidly. She died at 2 o'clock in the afternoon. Temperature 106.6° F., respiration 52, and a pulse of 120 just before death. She had remained conscious during this period and continued to ingest large amounts of water and hydrochloric acid, milk and cream, up to within

fifteen minutes of the time of her death, which seemed to produce no nausea or distention of any sort. Her CO_2 taken just before death was still 120 plus in spite of the administration of these large amounts of acid.

The report of Brown, Rowntree, McVicar, and the extensive experimental studies of Hayden and Orr, have put the clinical entity of alkalosis on a firm basis in the last few years. It is well known that obstruction high up in the intestinal tract, especially in the duodenum, will bring about this condition. Cases have been reported of duodenal stasis from tumors, kinks in the bowel, as well as postoperative obstructions. The symptom complex of this disease is quite typical. There is a dehydration, the red cells and hemoglobin being markedly increased, and large amounts of watery bile-stained material are usually vomited. The blood-pressure is low, asthenia marked. In other words, the patient presents the usual syndrome of shock plus certain uremic symptoms. The non-protein nitrogen urea and creatinin are all markedly increased, albumin and casts are found in the urine, and, if death occurs, renal pathology is noted in all cases. The characteristic feature is the enormous rise in the carbon dioxid combining power of the blood and a low blood chlorid. Therapy in this syndrome by the administration of acids has proved very successful in a vast majority of cases.

The first and most important thing, of course, is to relieve the obstruction by operation if necessary. After that is done the administration of hydrochloric acid by mouth and by rectum, calcium chlorid or ammonium chlorid to provide free chlorine ions has brought about marked benefit or a cure in a very high percentage of the cases reported. In the present instance, however, certain unusual features were noted about the case, the most interesting of which is the total absence of intestinal obstruction. All during the postoperative course there was an unusual ability to ingest and digest both water, medicines, and large amounts of milk and cream, at a much earlier postoperative stage than one would ordinarily administer them by mouth. Up until the last minute there was no distention, no vomiting or no nausea, or any other sign of obstruction either of

the stomach or of the duodenum, and the loss of fluids by vomiting to which certain authorities have attributed these symptoms was conspicuously absent. One might suggest that the administration of sodium bicarbonate as it is done almost routinely in many clinics by rectum was a feature of the case. It might indeed have aggravated the condition, but the amount given is insignificant compared to that which is administered daily in the medical wards under the Sippy management of ulcers, and one must look further for an explanation which is lacking unfortunately, as autopsy was not permitted.

What seems to me to be the most reasonable explanation is that the pylorus being blocked by the tumor, there was some obstruction of the afferent loop of the gastro-enterostomy, although the efferent loop remained wide open, thus allowing material to pass into the stomach and into the intestines and on through in the normal manner. Such a complication would leave a completely closed blind loop of the duodenum being blocked off at the pylorus by the tumor and distally by some kink, perhaps in the afferant loop, owing to the gastro-enterostomy, and would produce exactly this same train of symptoms. In fact, this practically has been done on animals by Luckhardt and Dragstedt in their studies, and Hayden and Orr in their chemical investigations.

I believe that this should teach us a lesson to watch carefully the postoperative course of our gastro-enterostomies which have obstruction of the pylorus to a high degree. I feel certain that a second operation, draining this blind loop, might have saved the patient if it had been decided upon in time. One should bear in mind this condition of alkalosis, as it is very difficult to diagnose except by chemical means. In this case the lack of temperature or leukocytosis and sudden onset of severe symptoms enabled us to make a diagnosis before death, but not in time to save the patient. I believe that this condition occurs in a less fulminating type of syndrome in a great many cases which die after gastro-enterostomy and remain entirely undiagnosed, and that we should constantly keep it in mind and by CO_2 estimations in cases which are not doing well attempting to rule it out.

CLINIC OF DR. WILLIAM J. GALLAGHER

PRESBYTERIAN HOSPITAL

BENIGN LYMPHENDOTHELIOMA IN A CYSTIC LYMPHANGIOMA

CYSTIC lymphangioma in the parotid duct region is so rare that it has seemed worth while to report the following case:

Mr. P. M. entered the hospital November 11, 1924, with a tumor in the region of the right parotid duct. He stated that it had been first noticed by him nine years ago, and that it was growing gradually larger during the past year. It had never reduced any in size and was without subjective sensations. On account of the increase in size of the tumor and the apprehensiveness which it caused him surgical aid was sought.

There was no history of trauma or infection in this region of the face.

The mass measured 5 by 3 cm., was semisolid, and extended from 2 cm. in front of the right ear lobe along the course of Stenson's duct. It was not tender and was not adherent to the skin, but seemed to be somewhat so to the underlying structures. Clear fluid was observed to escape from the duct in the mouth on this side. A fine probe could be passed into the duct without obstruction up to the parotid gland. But movement vertically of the probe also resulted in movement of the tumor, which appeared to be in close contact with the duct, so that it was thought the mass was either a cystic degeneration of the socia parotidis or a cystic condition of the wall of the duct rather than a dilatation of the duct itself.

For these reasons, under local anesthesia, an incision was made parallel to Stenson's duct, directly over the tumor (Fig. 204). A probe was inserted in the duct, through the mouth, to aid in identifying its wall during the dissection. After cutting

through the superficial fascia, a bluish, elongated, irregular shaped cystic tumor was exposed. It tapered at both ends, and extended from just beneath the anterior margin of the parotid gland along the course of Stenson's duct, to which it was closely adherent. The buccinator branch of the facial nerve was adherent to its outer wall. The tumor was freed from these structures and entirely removed. The incision was closed without drainage.

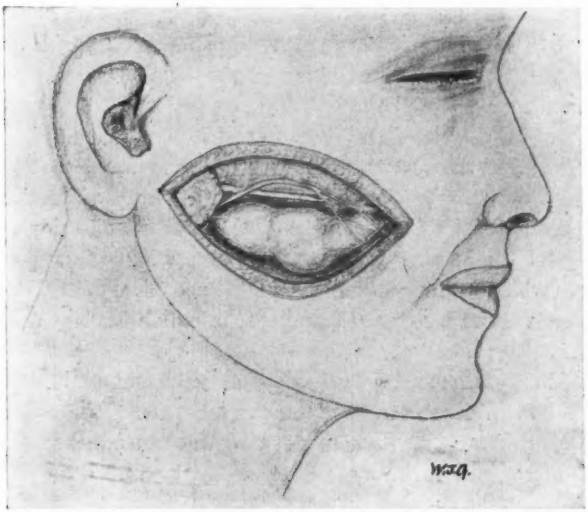

Fig. 204.—Photograph of drawing made from memory after completion of the operation. Stenson's duct behind tumor. Buccinator branch of the facial nerve freed from tumor wall, anterior margin of parotid gland.

Pathology.—The cyst was multilocular, with a smooth inner lining, and filled with a brown fluid. The medial fourth was filled with tumor tissue, which was adherent to the wall of the cyst.

Microscopic examination was made by the hospital pathologist: Embedded in dense, fibrous stroma is a large thick-walled cavernous space lined in part by a thin single layer of flattened endothelial cells, and in part by a single or double layer of larger cuboidal cells. In places the latter pile up and

become many layered. At two places there has been formed within the original cavernous space a mass of tissue composed of fibrous stroma in which are embedded numerous cellular alveoli. It is apparently not malignant.

Diagnosis.—Benign lymphendothelioma in a cystic lymphangioma.

Comment.—The interesting features of the tumor are its relation to the parotid duct, simulating enlargements of the

Fig. 205.—Microphotograph (× 20) of cyst wall with proliferating endothelial cells, beneath which in the wall of the cyst is an isolated nodule of endothelioma.

duct, the proliferative tendency of the endothelium giving rise to an endothelioma which extended into the wall of the cyst and hemorrhage into the cyst, presenting a characteristic of a malignant growth.

Pathologically[1] three types of lymphangioma are usually described[2]—simple, capillary, and cavernous or cystic.

The cystic type may have single or multiple cysts in a new

growth of lymph channels. The most common sites are in the neck (hygroma cysticum colli), axilla, tongue, and lips (macroglossia and macrocheilia), in the sacral region (sacral hygroma), and in the extremities (elephantiasis).

The cause is not definitely known, although most writers[2] consider them congenital in origin, but many (as in this case) do not appear until adult life.

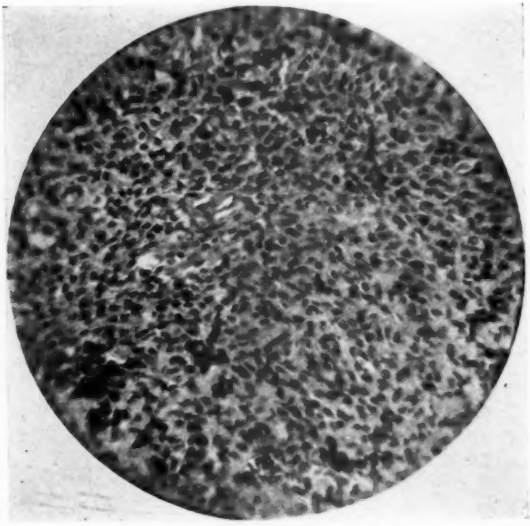

Fig. 206.—Microphotograph (× 300) of nodule of tumor in Fig. 205.

Numerous possibilities are given for their formation.[3] Occlusion of lymph vessels, which become dilated due to lymph stasis; active proliferation of the endothelium of newly formed lymph vessels; a new formation of lymph vessels from connective tissue, as the proliferation of granulation tissue, in which infection and trauma may be factors[1]; errors in development of the lymph vessels, with increased secretion of the endothelial cells and with decreased permeability of the wall; and finally the theory of Dowd[6] which seems to be most commonly accepted, especially in explaining cystic lymphangioma of the

neck. He called attention to the relationship of the jugular lymph sac of certain adult fishes and vertebrate embryos with the site, anatomic relations, and cystic character of these growths. He therefore believed that the condition was due to embryonic sequestration of lymphatic tissue. His views are further substantiated by the findings of several anatomists[6, 7, 8] on embryos and the occurrence of rests in dissected necks.

The logical treatment of these tumors is total removal where practical.

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CLINIC OF DR. CLEMENT L. MARTIN

MERCY HOSPITAL

ANORECTAL DISEASE

Case I.—This young man was referred to the dispensary for a hemorrhoidectomy. His chief complaint is the passing of blood per rectum during the last two months. He is concerned about the bleeding, his attention is fixed on it; he attributes all his trouble to it. But inquiry discloses that he has three loose bowel movements a day, that he has lost much strength and 20 pounds in weight in the last two months.

Proctoscopic Examination.—There are multiple discrete ulcers in the rectum and sigmoid. These are elliptical or circular and on rather flat-topped elevations which project about 2 mm. above the adjacent mucosa; the bases of these elevations are approximately from 5 to 7 mm. in their long diameter; the ulcers are from 3 to 5 mm. in their long diameter. Some of the ulcers have a dirty yellow to gray membrane of necrotic material covering them; others are red where this membrane has come away. The blood this patient has noticed comes from the latter type.

The mucosa between the ulcers looks normal, except for a moderate hyperemia in some areas. This picture is pathognomonic of amebic ulceration. Not every case of amebic ulceration is as characteristic as this, and one should always confirm the proctoscopic findings by having stool examinations made to determine the presence of parasites by one who is really competent. Only about 10 per cent. of patients suffering from amebic colitis have amebic ulcers visible on proctoscopic examination.

Amebic colitis with ulceration may be differentiated by

proctoscopic examination from chronic ulcerative colitis caused by Bargen's diplococcus; this is the lesion with which it is most apt to be confused. However, the appearance of the mucosa is quite different in the two diseases. Isolation and identification of the diplococcus confirms the diagnosis in chronic ulcerative colitis. This patient will be transferred to the medical division, where if stool examinations show the presence of the amebæ, stovarsol or emetin will probably be the medication given him.

Fig. 207.—Amebic ulcers.

This case emphasizes the necessity of a visual examination of the rectum and sigmoid before undertaking an anal operation. A trite observation, perhaps, but it does need repetition, as this case shows.

Case II.—Ulcer from Phenol Injection for Hemorrhoids.—Male, aged forty-seven, enters with complaints of pain and bleeding. Summarizing the history, he has had hemorrhoids for ten years. They protrude and must be replaced after every bowel movement during the last two years; they bled with every

defecation, but never more than a few drops in the last year. He has taken a daily cathartic for several years. He was given phenol injections for his hemorrhoids seven, five, and two days ago by a man who has been doing this sort of work for years. Yesterday he had continuous burning pain in the rectum, sharp pain when the bowels moved, tenesmus, a desire to defecate four times during the day and once last night, and on defecation at these times passed only bloody mucus.

Proctoscopic Examination.—There is an 8 x 12 mm. ulcer, with edematous, raised and curled, overhanging edges, on the anterior wall of the rectum, 2 cm. above the anus. It bleeds readily. Just below it there is a strip of necrotic mucosa from 3 to 4 mm. wide, extending to the anus, and a similar strip of necrosis through the skin of the anal canal.

His pain is caused by the attendant inflammatory reaction and sphincter spasm from this necrosis in the anal canal. The ulcer is the result of an injection of phenol into an internal hemorrhoid, and the strip of necrosis is the consequence of leakage from the injection site. The patient is worse off than before he was treated and still has his hemorrhoids. However, unqualified condemnation of injection therapy for hemorrhoids is wrong. Good results are obtained by competent men using either quinin and urea hydrochlorid or phenol solutions in properly selected cases. By properly selected case is meant true uncomplicated internal hemorrhoids. The therapy has definite limitations. Recurrence is more frequent after injection treatment than after hemorrhoidectomy.

An ulcer may follow the unskilled use of either quinin and area hydrochlorid or phenol solutions. Even with the experienced it occurs at times as evidenced in this patient. Some of the more serious consequences of injection therapy I have seen are: severe proctitis with ulceration, a large infrapelvic abscess, and rectal stricture.

Case III.—Rectal Adenoma.—Male, aged forty-two, enters with the chief complaint of rectal bleeding. This patient states he has a cancer of the rectum. Six or seven years ago he noticed

a drop or two of bright red blood in the feces occasionally; the amount increased slightly in the last two years. The last three to four months he has passed blood, usually dark, but at times bright red, with every defecation. He bleeds more when the feces are hard. An advertising "rectal specialist" told him he had cancer of the rectum and suggested he have someone else care for him.

Proctoscopic Examination.—Internal hemorrhoids of moderate degree are present. There is a dark red, lobulated, irregularly spherical neoplasm attached by a short pedicle to the anterior rectal wall 6 cm. above the anus. This is a typical rectal adenoma, commonly called a polyp. It looks benign. Microscopic examination is required for absolute accuracy in diagnosis. Experience may enable one to form an opinion from the gross appearance of the adenoma which will be correct in a high percentage of cases.

Treatment.—Fulguration of the pedicle of this growth through the proctoscope will be a very satisfactory method of removal. In general, the treatment of adenoma of the rectum or sigmoid depends upon whether it is malignant or not and its size and location. In the last few years an excellent agent for the removal of these growths is had in fulguration. It is possible to use it for tumors relatively inaccessible to other methods, and it has practically done away with postoperative hemorrhage in these cases. In rare instances it is an effective measure in the attack upon low-grade carcinoma. When used where it is properly indicated it is a very satisfactory procedure.

Benign Adenomas.—Adenomas visible through the proctoscope may be removed by this means. However, several conditions may make it inapplicable. For instance, multiple, closely aggregated adenomas involving very much mucosa are not amenable to this treatment. If the growth is very large, even though it is single, or if it has a very broad pedicle or if it cannot be well exposed by the proctoscope, then fulguration may be used only in the exceptional case. Injury to the bowel wall where it is covered by peritoneum is a serious danger.

Adenomas with a pedicle 1 cm. or less in diameter, anywhere

in the rectum and in the sigmoid where they can be well exposed, may be fulgurated to advantage.

The larger tumors, 2 cm. or more in diameter, in the lower rectum can often be excised through the dilated anus. If the upper border is more than 6 cm. above the anus, excision per rectum is ordinarily impossible. The larger adenomas above the level of the peritoneal reflection on the bowel, and this is usually from about the level of the third rectal valve, are best excised

Fig. 208.—Rectal adenoma.

by transperitoneal sigmoidotomy or resection. The larger adenomas situated below the level of the peritoneal reflection and above 6 cm. from the anus cannot be so readily classified for treatment. Fulguration may be indicated or excision through a posterior proctotomy may be advisable. The patient's general condition, the presence of associated disease, age, sex, and other factors, may be important considerations in the decision. A large mass of necrotic tissue in the rectum after fulguration of the larger growths, a large ulcer to heal and contract where

the adenoma has been separated from the intestinal wall, the danger of injury to the seminal vesicles or bladder in men, the danger of peritoneal injury in women, because of the lower position of the culdesac, especially in those who have lax pelvic walls, must all be taken into account when fulguration is employed.

Carcinomatous Adenomas.—Excision is the method of choice in the treatment of carcinoma of the intestinal tract, whether

Fig. 208*a*.—Adenoma of rectum. × 67. Note high degree of differentiation of epithelium.

in the stomach, rectum, or elsewhere. When one can be certain of removing all of the carcinomatous tissue it is the best method. Excision probably offers advantages over fulguration in most of the carcinomatous adenomas of the rectum and sigmoid. The prevention of recurrence is the important consideration here as in the treatment of carcinoma elsewhere. Carcinomas in

this region are usually of the lower degrees of malignancy and the carcinoma is definitely localized for some time. This offers an excellent indication for excision.

However, in the smaller carcinomatous adenomas, 2 cm. or less in diameter, and those with moderate sized pedicles which can be well exposed by the proctoscope, fulguration may suffice. It is a simpler procedure than excision generally and with less risk to the patient. If the pedicle is divided by fulguration recurrence should be no more frequent than after excision.

That these neoplasms are of low-grade malignancy should not make us unduly complacent about them; they are of serious consequence, and too many of them have attained a fair size, 3 cm. in diameter or larger, when first seen. These ordinarily require excision.

Those of moderate size, near the anus, except those on the posterior wall, can be excised per rectum without injury to the sphincter. Those in the sigmoid are excised by transperitoneal sigmoidotomy or resection. Those above a point where excision per rectum is possible and below the rectosigmoid juncture offer, in addition to the consideration of malignancy, the same problems discussed in relation to simple adenoma in this region. Each case must be considered individually.

Briefly, fulguration offers an excellent means of destruction of most of the benign adenomas of the rectum and sigmoid, colon, and in some instances of the carcinomatous adenomas. Excision is the method of choice with most of the carcinomatous adenomas.

Case IV.—Male, aged twenty-seven, admitted with chief complaint of constant rather severe pain in rectum. History: Three weeks ago he first had a dull pain about the anus; it became worse that night and he saw a doctor the next day. Ointments were applied locally, without relief. The constant dull ache in the anus was worse when he walked or sat down. There was pain with defecation, but not of a sharp or cutting type.

Four days after onset he was awakened by severe anal pain.

A second doctor was called. The course of the trouble has been progressive since the onset three weeks ago. He has been in bed the last three days, sleeps fitfully at night because of pain. He has been unable to work the last three weeks.

Anal Examination.—There is tenderness on pressure over the skin covering the external sphincter muscle in both posterior anal quadrants and a definitely localized area of maximum tenderness of a size covered by the finger-tip posteriorly and to the right of the midline. Induration, redness, or swelling are

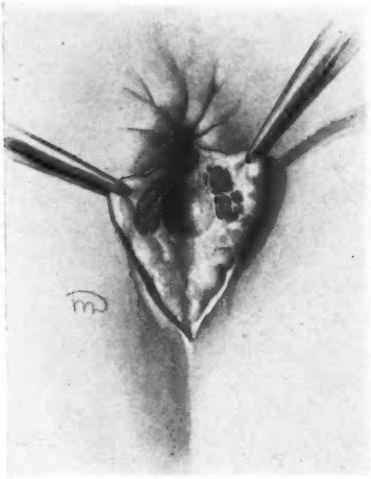

Fig. 209.—Deep marginal abscess.

not present. Digital examination of the anus confirms the presence of marked anal spasm observed on inspection. There is an area of tenderness in the posterior commissure of the anal canal and the tissues here feel boggy, but are not indurated or fluctuating. A markedly reddened crypt just to the right of the posterior anal commissure is seen when the anoscope is inserted. Adjacent to this crypt there is a small fissure a little less than 0.5 cm. in length in the skin at and just below the pectinate line. A fine flexible probe of No. 27 silver wire readily

enters a very small opening at the juncture of the fissure and crypt and goes in to the depth of about 1 cm.

Diagnosis.—Perianal abscess and anal fissure.

Operation is done under transsacral block anesthesia of the second sacral nerves and epidural injection with 1 per cent. novocain solution. As sphincter relaxation develops, a few drops of pus appear in the anus. It was probably the marked sphincter spasm which prevented the pus from following the probe as it was withdrawn during the examination.

An incision is made in the midline, posterior to the anus, extending from the abscess to a point well back toward the coccyx on the perianal skin and completely incising the external sphincter muscle. The fissure in the mucosa is excised. Overhanging edges of mucosa and skin are trimmed away to promote drainage and healing. Hemostasis is secured and the wound lightly packed with iodoform gauze after putting in a thin cigarette drain through the anus.

Discussion.—This was a small, deep marginal abscess of about 1 c.c. capacity between the internal and external sphincter muscles, associated with a small fissure. An abscess of this type may not be diagnosed because it does not present the symptoms of swelling, induration, and redness. The external sphincter lies over the abscess and rather effectually conceals it.

A point of maximum tenderness on palpation over the skin covering the external sphincter muscle is a valuable finding, and certainly should lead one to make an examination with the anoscope.

The incision must be adequate; that is, from the abscess to well back toward the coccyx. The external sphincter must be divided as a rule. The skin incision should be sufficiently far back and the edges so trimmed that the healing skin edge will not interfere with drainage as the wound heals.

CLINIC OF DR. WILLIAM J. PICKETT

MERCY HOSPITAL

TUBERCULAR LYMPHOMA OF THE NECK

History.—This patient is a male aged thirty-eight, who complains of pain in the left side of the neck of four months' duration. There is indefinite pain at times, but little tenderness. He was referred to Mercy Clinic by a physician to have the mass incised and drained.

Past History.—Parents living and well. No history of carcinoma or tuberculosis. Usual childhood diseases. No loss of weight. Four months ago he noticed a small tumor in the left side of the neck, which gradually became larger until it had attained its present size.

Physical Examination.—The patient is a thin, rather poorly nourished male. The tonsils are present and his teeth are in poor condition. There is no ulcerative or neoplastic lesion of the nose or throat. Heart and lungs are negative. There is a peculiar pallor of the skin, but no apparent loss of weight. The reflexes are normal. The white blood-count is 8000; red blood-count 3,700,000; differential smear does not show evidence of lymphocytosis. The blood Wassermann is negative.

There is a single tumor mass the size of a lemon on the lateral aspect of the neck, solid in consistency, does not fluctuate, and is somewhat adherent to the surrounding tissues. It is seen to occupy a position in the deep chain of glands beneath the anterior edge of the sternocleidomastoid muscle.

Since the patient insisted that the mass be incised an aspirating needle was introduced, with negative results. Under local anesthesia a section of the tumor was removed and found to consist of a large cell hyperplasia with no evidence of malignancy.

A case of this type is interesting for the reason that it presents a problem in differential diagnosis. Careful palpation and the use of the aspirating needle proved that no abscess was present. Considering the age of the patient and the fact that no chain of glands were present, it did not seem that the case was one of tuberculosis. The situation of the tumor might confuse it with a branchial cyst, but this is soft in the beginning, has a uniform outline, fluctuates as a rule, and is not adherent to the surrounding structures. The enlarged glands of Hodgkin's disease are collar-like in their situation and there are usually glands elsewhere in the body. Syphilis and metastatic carcinoma are not difficult to exclude. The possibility of the case being one of lymphosarcoma was seriously considered, and it was not until a section of tissue removed under local anesthesia proved that sarcoma was not present. The characteristics of the case, together with the knowledge obtained through biopsy, lead us to the conclusion that we are dealing with a case of solitary lymph-node tuberculosis, probably of the large cell type described by Zeigler.

Operation.—An incision is made along the inner border of the sternocleidomastoid muscle on the left side and a superficial and middle layer of the deep cervical fascia is divided. The external jugular vein is clamped. There is considerable bleeding due to the fact that some periadenitis is present. The anterior surface of the tumor is exposed and by careful dissection with retraction of the muscles the mass is slowly enucleated. It is apparently not adherent to the deep vessels of the neck. On removal of the tumor there is considerable oozing of blood, which is controlled by the insertion of a hot pack. The fascia is closed with plain catgut No. 1 and a small rubber tissue drain is left at the lower angle of the incision. The skin is closed with subcuticular catgut.

The mass is irregular in outline and firm in consistency. It does not include any additional lymph-glands. The capsule is thin and on cut section the surface is yellowish-gray in appearance. There is no cheesy degeneration and no pus formation.

A careful microscopic examination of the tumor mass proved

it to be a lymphoma containing considerable amount of connective tissue, large spindle cells, and a few lymphocytes. This is the unusual type of tubercular gland. There is not the tendency to caseation usually seen in this type of tumor and there is no breaking down of the mass. However, this might occur later on in the disease, and it would then follow the usual course of lymph-node tuberculosis. Tuberculous adenitis of the neck is unusual in a patient of this age, but it does occur. One would be rather more suspicious of a mass of this type being malignant. However, malignancy, as a rule, is much more rapid in progress and is seldom single. In spite of this we did entertain sarcoma as a diagnosis until its presence was excluded through tissue examination.

SALIVARY CALCULUS OF THE SUBMAXILLARY GLAND

History.—Male, aged thirty-three, has had diseases of childhood. Three years ago was treated for gastric ulcer and the symptoms relieved by alkalies and diet. There was an inguinal herniotomy performed about the same time. For the past three months he has been troubled with a swelling beneath the mandible on the right side of the neck. It is not constant in size and there are intermittent attacks of pain. At these times the swelling is tender, and firm pressure upon the gland by the patient brings about a secretion of some material with a foul odor, and this is accompanied by relief. On taking food the swelling becomes more prominent and the accompanying pain so severe that the patient is often forced to discontinue his meal.

Physical Examination.—A well-developed, well-nourished male. General examination is negative except for the scar of a left inguinal herniotomy. There is a tumor mass of indefinite contour and doughy in consistency occupying the right submaxillary triangle. It is only slightly tender and does not fluctuate. The interior of the mouth is negative and no nodule suggestive of salivary calculus can be palpated along the course of Wharton's duct. A probe readily enters the duct and can be passed backward a distance of 1 cm. There is no other cervical adenopathy.

Discussion.—The etiology of salivary calculi is still uncertain, although variously ascribed to oral sepsis, carious teeth, and gouty diathesis. Recurrent calculi have been noted in the same individual. If such a calculus is lodged in the anterior half of Wharton's duct it may be palpated with the finger in the floor of the mouth. In the case at hand no stone was palpable. The history, however, is almost sufficient to make the diagnosis. The condition had been chronic and consisted of periodic swelling of submaxillary gland which the patient states he could partially relieve by firm pressure. The most typical

symptom here present is that of intense pain, *salivary colic*, which occurred at mealtime. This was often so severe as to cause him to discontinue his meal. *x*-Ray examination was not thought necessary. The diagnosis was readily made at the first examination and removal of the gland advised. This the patient was not willing to accept at that time and sought relief elsewhere. However, he returned five days ago during a severe attack and demanded immediate operation. This did not seem advisable in view of the acute inflammatory condition of the gland. To afford relief and prepare the patient for operation a liquid diet, chiefly of milk, was advised. Atropin in suitable doses was prescribed to check salivary secretion and the use of the ice-bag recommended. This resulted in improvement to such an extent that the swelling is now only one-third of its previous size.

Operation.—Ether anesthesia. A curved incision with convexity downward is made beneath the right mandible sufficiently low to avoid injury to branches of the facial nerve, to the triangularis menti muscle, and to lie in the crease of the neck. The platysma muscle and superficial cervical fascia are incised and the flap retracted upward. The deep layer of cervical fascia is opened and the facial vein is ligated and tied as it is found to lie over the gland. The facial artery can be displaced out of the field and need not be divided. The hypoglossal nerve is not seen. The gland is carefully dissected free and the duct is clamped and its cut end cauterized with phenol. It is important to remove all the gland tissue or there is danger of salivary fistula resulting. A small rubber wick drain is left at the lower edge of the wound. The platysma muscle is sutured with No. 0 catgut and the skin closed with a subcuticular suture. A snug dressing is applied to occlude any empty space resulting and an ice-bag will be employed if there is any swelling.

The gland itself is about the size of an English walnut. It is firm and cuts with some resistance. On opening it there is seen some decomposed material and a slight amount of pus with a foul odor. In the distal end of the gland is found a calculus about the size of a large pea. This stone would not have passed

through the duct, in fact, its presence in this portion of the gland produces a ball-valve action similar to that of a gall-stone situated at the ampulla of Vater. The condition of the gland with the possibility of further trouble warrants its removal.

Microscopic study reveals chronic inflammation of the glandular tissue with the formation of small abscesses.

CLINIC OF DR. FRANCIS H. STRAUS

PRESBYTERIAN HOSPITAL

ABSCESS OF FEMORAL CONDYLE

THE patient upon whom I shall operate this morning is a storekeeper forty-three years old. He has been under observation twice before during the last eighteen months. Since his past history has a distinct bearing on our problem this morning I shall present it in some detail.

He first entered the hospital eighteen months ago. At that time he told us that he had been operated upon for acute appendicitis two months previously, and that his convalescence had been complicated by frequency and burning urination. The urinary symptoms had never entirely disappeared and lately he had developed an aching pain in the left costovertebral region as well as irregular attacks of chills and fever. Study in the hospital showed him to be suffering from a definite left pyelitis. He was discharged after a short period of treatment, apparently well.

We saw him again four months ago, when he entered the hospital complaining of severe pain in his left leg. This had begun five weeks before his admission as a dull boring pain noted only at night, but had increased so that it was present most of the time. Walking and use of the knee-joint gave him distinct relief. He was unable to localize the pain, but placed it as being somewhere in the lower half of his thigh. Examination showed nothing but a slight flabbiness of the muscles of his thigh and calf, and 3 cm. less circumference of the left than the right thigh. Skiagrams and a blood Wassermann test were negative. He was kept in the hospital for two weeks, during which time, in spite of very careful study, we could come to no conclusion as to the cause of the pain. We finally discharged him with a half-

formulated impression that he might be developing a spinal cord lesion, and instructed him to return periodically for observation. As he lives at some distance from Chicago he was unable to do this.

We did not see him again until he was brought into the hospital on a stretcher ten days ago. During the interim he had suffered continuous severe pain. Much of the time he had been unable to sleep and he had lost a good deal of weight. Six weeks ago he had a sudden swelling of his left knee-joint which had slowly subsided. Three weeks ago there had been another such swelling which a physician had aspirated, removing two syringes of yellow fluid. Since then his knee-joint has remained partially flexed and he cannot bear his weight upon it in walking.

You can see grossly that there has been very extensive atrophy of the left calf and thigh muscles, and that the knee-joint is held by muscle spasm to a flexion of 135 degrees. There is no evidence of fluid in the joint and no tenderness to pressure anywhere over the leg.

I had skiagrams again taken of the leg and was just able to make out a slight diminution of density in the medial condyle of the femur. This was very indefinite, and I did what I have often found useful in the demonstration of similar poorly defined lesions in bone. I asked the *x*-ray department to make new films with a considerable degree of overexposure. This throws out of the film all soft tissue shadow and leaves the bone trabeculæ standing out with much greater distinction, so that previously vague changes in trabecular lines become surprisingly distinct. This procedure was useful here, for in the new films there is a definitely outlined area of lessened density in the medial side of the femur. It is about the size and shape of an olive, and at one point is within $\frac{1}{8}$ inch of the joint surface. In retrospect, I am very sorry that I did not have overexposed films taken four months ago, as I believe that by their use we could have seen the lesion then when our usual films were apparently negative.

From the standpoint of diagnosis we have then to consider a patient with a chronic lesion in the medial condyle of the femur

which after five months caused an area of bone destruction to appear in *x*-ray films. Lues has been pretty well ruled out by negative history and Wassermann. From a clinical and *x*-ray standpoint it might well be either a neoplasm or a low-grade inflammatory process. The amount of pain he has suffered all through his illness speaks rather against a centrally situated neoplasm; but still more important in this differentiation are the recent attacks of acute arthritis with exudation into the joint. If they had been due to involvement of the joint by an expanding or infiltrating neoplasm, the cause of the irritation would not have disappeared, and it is unlikely that the exudate would have been reabsorbed. The evanescence of the fluid suggests invasion by a low-grade organism with combat and rather rapid victory of the joint defense. Such a lesion as we have here, if inflammatory, might be due to one of the pyogenic organisms—what is often called a Brodie's abscess, or it might be tuberculous. The clinical evidence, except for the old history of a pyogenic kidney infection, is of no help in the differentiation. The *x*-ray evidence is strongly in favor of tuberculosis. The location entirely in the epiphysis is not as important a factor in a man of forty-three as it is in a child, but what value it has is entirely in favor of tuberculosis. The fact that the bone changes consist entirely of absorption without any surrounding area of denser bone proliferation is very strongly in favor of tuberculosis as against a pyogenic abscess. But these bits of evidence are not conclusive, and it is important that we obtain accurate knowledge of the etiology, as our operative therapy will be very different in the two instances. In the case of tuberculosis with an already beginning joint involvement in a man of forty-three who has a family to support I would be inclined to make a rather extensive excision of the diseased bone and joint. We would thereby obtain an early ankylosis and return to active use. If we could determine that the causative organism was one of the pyogenic group we would be much more conservative in our treatment.

In order to decide this point a week ago I made a small exploratory incision into the joint. There is a definite place

for such an arthrotomy in a case of this sort where the importance to the patient of the knowledge to be gained is very great. There is no exudate to aspirate and study, and imminent extension of the disease process to the joint makes further observation hazardous. The arthrotomy showed the joint surface to be grossly normal in appearance. A small piece of synovial lining was excised for microscopic study and the wound was closed. This is now healed, and study of the section has given us the information we needed. The synovia shows definite evidence of a subsiding pyogenic infection, chiefly a perivascular infiltration, with cells that are almost exclusively leukocytes.

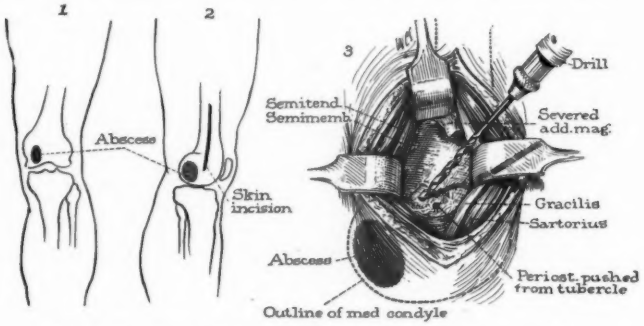

Fig. 210.—Extra-articular approach to the median condyle.

The patient is now anesthetized and I have placed a Martin constrictor around the thigh so that I shall not have to attend to hemostasis during the operation; but chiefly so that I shall have an unobstructed view of the structures and the pathology of the lesion. I have planned my incision so that there will be no danger of opening and contaminating the joint by the pus which I expect to find. Approach to the medial condyle either anteriorly or posteriorly is out of the question, as the joint cavity would have to be traversed either way. Yesterday I dissected a number of cadavers and found great variation in the point at which the synovia is reflected from the medial side of the condyle. The only landmark that was constant was the tubercle to which the adductor magnus tendon is attached.

This was always above the joint margin (Fig. 210). Accordingly, I make my incision from this point upward for 3 inches. I am retracting the sartorius and gracilis anteriorly and the semimembranosus and semitendinosus posteriorly. This brings me down to the tubercle which is covered by the tendinous attachment of the adductor magnus. This I cut and retract the muscle upward. I can push the periosteum back from the tubercle exposing about a square inch of bone which is well above the lesion, but as close as I can approach without risk of opening the joint. I now pass a drill downward and laterally in the direction of the center of the condyle and can feel it meet with no resistance at a depth of about 1 inch. As I withdraw the drill I expect to see pus, but I am disappointed. However, I know that I have entered the cavity, so I am enlarging the drill hole with a gouge, and I can see the cavity filled with very thick gray pus.[1] I have sponged it out and am now exploring the cavity with a probe to be sure it does not communicate with the joint. In this clinic our usual practice with very low-grade bone abscesses of this type has been to curet the cavity, cleanse it with hydrogen peroxid and alcohol, fill it with iodoform-glycerin emulsion, and close the soft tissues into the cavity as far as possible after removing the bony roof. In most cases the soft tissues heal primarily and there is no subsequent evidence of infection. Here, however, the shell of condyle between abscess and joint is too thin to risk either curettage or a flareup of infection, so I shall have to content myself with drainage and slow repair by granulation. I am gouging away as much of the roof of the cavity as my necessarily slanting approach permits and have inserted an iodoform gauze drain. I have removed the constrictor and ligated the few bleeding points. The skin above my drain is being loosely closed with silk sutures. A rather firm dressing is applied and the knee immobilized by a molded plaster splint.

In reviewing this case I have had re-emphasized to me:

1. The unreliability of *x*-ray and anatomic guides in differentiating tuberculous and low-grade pyogenic bone abscesses.

[1] Cultures of the pus showed Staphylococcus albus.

2. The occasional value of arthrotomy purely as a diagnostic measure.

3. The value of overexposure in making some bone lesions more evident in the skiagram.

4. The elaborate approach necessary to reach the medial condyle without traversing the knee-joint.

GUNSHOT WOUND OF THE KIDNEY

THE patient has just entered the hospital and has been brought immediately to the operating room. She was shot by a revolver bullet half an hour ago. The wound of entrance is in the right midaxillary line below the costal margin. The wound of exit is over the center of the upper portion of the sacrum. It is obvious that the bullet must have traversed a part of the peritoneal cavity. She lies quietly and does not seem to be suffering much pain, but her general condition is not good. She is very pale, she is sweating a little, and her pulse is weak and rapid. Her abdomen seems slightly distended, but there is no rigidity or tenderness.

While she is being scrubbed and anesthetized I shall ask that hypodermoclysis of normal salt solution be given under her breasts, and allowed to continue during the operation.

I am now making a midline incision with its center at the level of the umbilicus, as I wish a full view of all the abdominal contents. I have opened the peritoneal cavity and at first inspection it shows nothing abnormal. However, as I pass my hand into the pelvis I find about 500 c.c. of blood. I am now systematically examining the intestine and mesentery, beginning at the rectum and working toward the stomach, but still I find no evidence of injury. Yet the injured structure must be in communication with the peritoneal cavity or I should not have found the blood in the pelvis. I have now found the wound of entrance where the bullet entered the peritoneal cavity, just under the corresponding skin wound. And here also I find the explanation of the failure to find any injury to bowel or mesentery. The bullet only crossed a small portion of the right upper quadrant and there is a wound of exit in the posterior parietal peritoneum just to the outer side of the peritoneal reflection over the ascending colon. This latter wound is bleeding profusely and the peritoneum over the right psoas muscle is pushed upward and bluish where it is distended by a huge hematoma.

The posterior parietal peritoneum is incised (Fig. 211) and retracted to each side. After I lift out the blood-clots I see that the fresh bleeding comes from the lower pole of the kidney. About the lower fourth of the kidney has been shattered and is lying in small fragments in the surrounding blood-clot. The surface of the wound in the kidney is rough and crumbling and is bleeding vigorously, but I can now get my thumb and index-

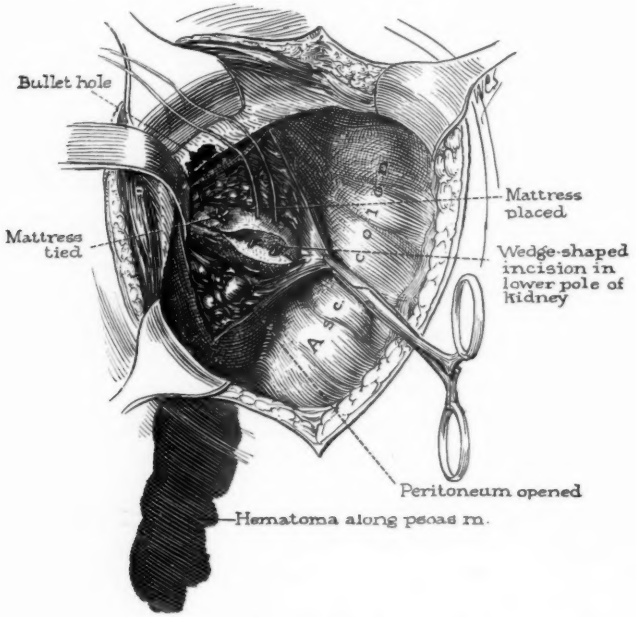

Fig. 211.—Closure of kidney wound.

finger on each side of the kidney, and a very moderate pressure controls the hemorrhage.

Ordinarily I should consider a nephrectomy the most advisable procedure in the face of a shattering injury to kidney tissue. I could very easily remove it through the very wide exposure that I now have. But here the upper three-fourths of the organ can be seen to be uninjured and I can see that the

ureter has not been damaged in the further course of the bullet. If I can débride and close the kidney injury and control the bleeding, the risk of postoperative oozing into the perirenal space or renal pelvis should not be much greater than after the more formal nephrotomy procedures, and the remaining large amount of kidney should be able to give good functional service. Accordingly, I am shaving off the rough friable contused surface of the kidney wound. The groove left by the projectile makes it easy to do this, so that the resulting tissue defect is wedge shaped with its apex upward. Its surfaces can be easily approximated. I am now placing two deep wide mattress-sutures so as to bring the raw surfaces into apposition. I cannot yet release my compression of the kidney substance, so I shall ask my assistant to tie them with only a moderate tension, as sutures cut through the friable kidney tissue very easily. The finger compression of the kidney is now released and no bleeding results. There will probably be some necrosis from pressure as the tissue swells within the sutures. This may open a calyx, so that it can leak urine into the perirenal fat. Accordingly, I am placing a cigarette drain from the sutured margin through a stab incision in the lumbar region. The reflected parietal peritoneum is closed over the kidney. The abdominal incision is closed without drainage.

Postoperative Note.—For twenty-four hours after operation the urine was grossly blood tinged. Subsequently microscopic amounts were noted for six days and then disappeared.

CLINIC OF DR. ISABELLA C. HERB

PRESBYTERIAN HOSPITAL

AN UNUSUAL CAUSE OF OBSTRUCTED BREATHING DURING NARCOSIS

MISS B., aged thirty-five, entered the Presbyterian Hospital suffering with carcinoma of the breast. The following is a part of the history taken by the intern on admission into the hospital:

Patient has had the ordinary diseases of childhood. Thyroidectomy was done in another hospital eight years ago. Following the operation she had pneumonia, after which she developed pleurisy with effusion. Two years after the thyroidectomy the patient had two severe attacks of tonsillitis which were followed by rheumatism.

Present Condition.—Well-nourished woman, heart and lungs normal, some enlarged cervical glands. No abdominal pathology. Complains of some dyspnea on lying down.

The day after her admission to the hospital a radical breast amputation was performed by Dr. Arthur Dean Bevan. Nitrous-oxid-oxygen-ether sequence was employed for induction and the open method of etherization used for the maintenance of anesthesia. The induction was quiet, with normal respiration and heart action; however, slight cyanosis soon developed, which rapidly increased to a considerable degree. The operation lasted nearly an hour, during which time the cyanosis continued, although the narcosis was so light that the patient moved about during the operation. Throughout the anesthesia there was a peculiar sound not unlike the laryngeal spasm which develops when a too concentrated ether vapor has been administered during induction. Different methods for the relief of the condition were instituted without corrective results. Nitrous-

oxid-oxygen was substituted for ether, and finally pure oxygen was administered, with no relief of cyanosis, which continued for some time after the patient had fully recovered from the narcosis. Never having had such an experience, and feeling that some pathologic condition due to the thyroid operation was responsible for the cyanosis, I asked Dr. George Shambaugh to examine the throat.

His report follows:

Difficult respiration on slight exertion and attacks of dyspnea coming on at night when asleep. Patient awakens to find herself struggling for breath. Speaking voice is low with moderate huskiness. Patient is a proof-reader and reads aloud for nine hours every day. Voice never tires. Symptoms developed eight years ago following an operation for goiter. For a month after operation she was forced to sit upright both day and night because of difficult respiration. Gradually experienced an improvement after one month. On quiet respiration a sound is produced on inspiration which resembles that associated with deep sleeping. Patient is unable to clear the larynx by coughing.

Inspection of the larynx showed the vocal cords somewhat thickened and rounded out, but without congestion. The left cord distinctly broader than the right. The cords were closely approximated in the middle line. No movement whatever toward opening the glottis was effective by inspiratory efforts. While breathing quietly the cords dropped slightly apart, not more than a couple of millimeters. The intrinsic muscles of the vocal cords which bring the free edges of the cords together on phonation perform their function normally. At end of quiet respiration the cords drop slightly apart, but no movement whatever is noted in the arytenoid cartilage. On forced inspiration the relaxed cords are drawn together and give rise to the difficulty described above. The phenomena presented here is that of bilateral paralysis of the crico-arytenoideus posticus.

Incomplete paralysis of the recurrent laryngeal is the common sequel of operations on the thyroid. The result, when the lesion is one sided and complete paralysis, is hoarseness, but no difficulty in respiration, the reason being that

the vocal cord assumes a position midway between phonation and deep inspiration. Eventually the normal opposite cord crosses the middle line and approximates the fixed diseased cord. With this the voice improves, but is still likely to be somewhat husky. In cases where recurrent laryngeal nerves have been severed, both cords assume the above position, often called the "cadaver position." This destroys the voice, but, of course, causes no difficulty in respiration.

Attention is called to the difference in the history as obtained by the intern before operation and that of the throat specialist after operation.

It is perfectly evident that local or intratracheal anesthesia would have been the method of anesthesia selected had the condition been known before operation.

The patient made an uneventful recovery and left the hospital two weeks after operation.

While the plan of anesthesia in the Presbyterian Hospital is fairly well standardized, it is sufficiently flexible to admit of variations when the physical condition of the patient or operative measures demand a change in the anesthetic or the method of its administration.

Since we developed an efficient system of grounding,[1] ethylene-oxygen, which has completely displaced nitrous-oxid, administered alone or combined with small percentages of ether, in order to secure better relaxation or to prevent vomiting, is administered in about 70 per cent. of operations. The remaining 30 per cent. are divided between ether and local. It has been found that in toxic goiter and exploratory laparotomies a combination of local and ethylene-oxygen produces a more satisfactory anesthesia than either alone.

[1] Jour. Amer. Med. Assoc., December 5, 1925, vol. 85, p. 1788.

CLINIC OF DR. JOHN D. KOUCKY

RESEARCH AND EDUCATIONAL HOSPITAL OF THE UNIVERSITY OF ILLINOIS

TORSION OF OVARIAN CYSTS: DIAGNOSTIC VALUE OF REFERRED PAIN

ACCURATE diagnosis is a most important factor in successful surgery. In elective surgery diagnosis has made great strides through the discovery and application of numerous laboratory procedures. In urgent surgery lack of time prohibits the use of many of these tests. The resultant inaccuracy of diagnosis, its delays or improper operations, may in part explain our failure during the past two decades to attain any decrease in mortality in these emergencies. It behooves us, therefore, to study and to more fully appreciate the significance of the symptoms in these cases.

Pain is truly a blessing in disguise. In many abdominal catastrophies it is the only prominent symptom, but too often its character is non-specific. Referred pain in certain conditions is of definite diagnostic value. Examples of this are the referred pain of gall-bladder and kidney colic. Although not infallible, they are rightly accorded universal recognition. In another acute abdominal condition, frequently violently acute and at times obscure in origin, I have found the referred pain, when considered in conjunction with the other symptoms, to be of great diagnostic value. I refer to torsion of the pedicle of ovarian tumors.

The following cases illustrate my point:

Case I.—Mrs. R., aged fifty-four, housewife. When first seen the patient had been sick twenty-four hours. She complained of severe pain through the lower abdomen, repeated

vomiting, and prostration. The temperature was 101° F., white blood-count 24,000. A large tender cystic mass was palpable in the left lower abdomen and pelvis. She gave the history of a previous attack five months before, at which time a physician diagnosed a left-sided twisted ovarian cyst. On direct questioning the patient mentioned a pain below the right hip which began the same time as the abdominal pain, was much less severe, constant, and limited to the area between the hip and middle of the thigh on its outer aspect. Even the most of the tenderness and all of the tumor were on the left side; the diagnosis made was twisted cyst of the right ovary. At operation the findings were a unilocular serous cyst of the right ovary with a pedicle twisted twice, clockwise. The tumor itself lay in the left side of the abdomen.

Case II.—Mrs. C., aged seventy-two, housewife. This patient bore 8 children and had never been seriously ill up to two years ago. Since then she has had attacks of abdominal pain occurring irregularly about once a month and lasting from a few minutes to twenty-four hours. These pains came suddenly, were present throughout the entire abdomen, and were associated with repeated vomiting, prostration, and residual generalized abdominal tenderness. With each attack there was moderately severe pain localized over the outer aspect of the right leg, extending from the hip half-way to the knee. At operation we found a moderate amount of blood-tinged abdominal fluid and a plum-colored fibroma of the right ovary about 6 cm. in diameter. Its pedicle was about 15 cm. long and apparently not twisted at the time of operation.

The above 2 cases illustrate the value of knowledge of this pain in the thigh. In the first case the diagnosis of a twisted ovarian cyst was evident; its localization, however, on the right side was possible only through appreciation of the significance of referred pain. In the other case it was of great practical value. The patient had been seen by several physicians during an attack; gall-bladder colic was diagnosed and morphin given. The tumor was never found on physical examination, and the correct diag-

nosis again was possible only through an understanding of the referred pain.

I have seen 5 other similar cases in all of which pain was present over the upper part of the outer aspect of the thigh on the same side as the tumor. In one of these, a chronic torsion, the only pain present was in the thigh; in the others this pain was moderately severe and overshadowed by the abdominal pain. In some determination of the presence of this pain required direct questioning. In my recent report of 100 ovarian dermoids there were 5 cases of torsion, in 2 of which the leg pain was so prominent a symptom that they were subjected to, because of ignorance of this symptom, ureteral catheterization to rule out kidney pathology. Throughout the literature on torsion of ovarian tumors there is occasional mention of pain below the hips, but no significance is attached to it.

The origin of this pain is undoubtedly that of a referred pain. Pathologic conditions in the viscera produce pain in the areas of distribution of the spinal nerves of the cord segment with which their sympathetic nerves connect. For example, the viscera, the sympathetic nerves of which connect with the tenth dorsal segment, refer their pain to the skin areas supplied by spinal nerves from this segment. Unfortunately for diagnostic purposes the nerves from one visceral organ end in several cord segments, and each cord segment receives nerves from several viscera. This community of nerve endings does not produce selectivity. The ovarian nerve-fibers connect with the lower dorsal segments and referred ovarian pain is said to be localized in the sacral region posteriorly and just below and to the side of the umbilicus anteriorly. In torsion of ovarian tumors the pathology is not limited to the ovary. Twisting of the pedicle causes traction on the broad ligament and the surrounding peritoneum. The nerve-fibers of this peritoneal area connected with the second lumbar segment. The upper part of the lateral aspect of the thigh is enervated from the second lumbar segment.

I am convinced the great majority, if not all, cases of torsion of ovarian tumors have pain over the upper part of the lateral aspect of the thigh. It may be a presenting symptom; more

often it is overshadowed by the more severe abdominal pain, but direct questioning will reveal its presence. In questionable cases it, in conjunction with other data, will establish the diagnosis; in those in whom the diagnosis is evident from other data it is a further check, and also permits us to state definitely on which side the tumor originated.

CLINIC OF DR. GEORGE L. APFELBACH

COOK COUNTY HOSPITAL

THE SURGICAL MANAGEMENT OF A DIABETIC INFECTION OF THE LOWER EXTREMITY

History.—The patient is a male, fifty-seven years of age, admitted to the Cook County Hospital December 28, 1927.

He states that he has always enjoyed good health, worked as a clerk, eats well, and does not use tobacco or alcohol in excess.

About one year ago a physician told him that he had diabetes and put him on a diet. Since this time he observed unusual thirst, frequent urination, and in the last two weeks a loss of about 35 pounds in weight.

About six weeks ago he developed a "sore" on the back of his right little toe, also on the sole of his right foot. For seven days he has had pain and swelling in the foot with anorexia, malaise, chills, and fever.

The record shows that on entrance this patient appeared very ill. He was toxic, with temperature of 101° F., pulse 126, respiration 24. Haines' solution turns red with 1 drop of urine. Diacetic acid and acetone are also present in the urine. Acetone odor noted on the breath. Blood-pressure 140/100.

The history also shows that I saw this patient yesterday afternoon, December 29th, and left the following orders on the chart:

1. This is an emergency.
2. Milk diet, 6 oz. every four hours.
3. Give 300 c.c. of orange juice per mouth and 15 units of insulin; repeat the same tomorrow morning.
4. Examine urine every four hours for sugar, diacetic acid, and acetone.
5. Blood-sugar every other day.
6. Blood-culture.
7. Wassermann.

8. Call in medical resident to assume the diabetic care of the patient.
9. Hot boric compresses every four hours to leg and foot. Elevate extremity.
10. To be taken to the operating room on the following morning. Morphin sulphate, gr. $\frac{1}{4}$, one-half hour before operation.
11. Push fluids.

Examination of the history today shows that the last urine analysis made at 8 A. M. shows no improvement in the sugar estimation, but does show an absence of diacetic acid and acetone.

Examination of the Patient.—I am showing you a very obese patient, a typical diabetic (Fig. 214), with a carbuncle and infection of the foot and leg. His tongue has improved since yesterday, showing that he is less dehydrated. The intern has not only pushed fluids per mouth, as ordered, but has given this patient 200 c.c. of normal salt solution under both pectoral muscles.

Fig. 212.

Foot and Leg.—The odor is almost nauseating. You see here a terrific infection. Can we combat this condition or should we proceed to an amputation? I feel certain that with such a high blood-sugar, as no doubt is present, even without acidosis, this patient would succumb from further infection of the stump.

Let us examine the limb more closely. There is a large carbuncle over the internal malleolus (Fig. 212), forming a circle

about 4 inches in diameter, merging into swelling and redness over the entire lower third of the leg. There is fluctuation over the

Fig. 213.

Fig. 214.

carbuncle from which exudes pus and in the tissues about the tendo achillis. Even the plantar surface is distended. There are two openings from which pus is draining, one over the dorsum

of the little toe and from the outer side of the fourth digit, proximal phalanx, plantar side. The dorsum of the foot does not fluctuate, but is reddened and edematous. I can palpate here an enlarged femoral gland. There are no visible evidences of an acute lymphangitis or thrombosis.

I cannot palpate pulsation in the dorsalis pedis and posterior tibial arteries because of the infection and edema. I think I can feel the popliteal, although this patient is obese and suffers pain when I flex the thigh and leg to make the test.

The Moskowitz test is contraindicated in this patient because I would probably throw into the circulation infective material if I applied the tourniquet used in this test.

Moreover, there are no evidences of gangrene present. Nevertheless we must keep in mind that these infections in the lower extremities of diabetics most often arise in small areas of necrosis due to obliteration or occlusion in an arteriole or small artery.

I have decided not to amputate, but to treat the infection, depend on my internist for diabetic management, and to obtain later any information as regards osteomyelitis or impending gangrene.

Operation.—The patient is being anesthetized with nitrous oxid, using enough oxygen to prevent a lowering of the carbon-dioxid combining power of the blood.

I have completely excised the carbuncle, which involves all the tissues down to the internal malleolus.

In incising these abscesses we always open the tissue in the entire extent of the infection, and where possible, with through-and-through drainage (Fig. 213), avoiding traumatism and injury to tendons and joints.

The plantar abscess is best drained by lateral incisions. The incision on the outer side of the foot extends up to the lateral sides of the fourth and fifth digits.

The lower leg is being opened, exposing a fascial plane infection. The abscess lies between bone and the tendo achillis. Through-and-through drainage is also advantageous in this abscess.

After placing soft fenestrated rubber tubes through the

plantar abscess and anterior to the tendo achillis, hot boric compresses were applied and the patient allowed to awaken.

DISCUSSION

Surgery in Diabetics.—The surgeon in serving a diabetic is dependent on the internist, the latter on the surgeon. Joslin (Text-book on Diabetics) states that "diabetic patients stand in need of the surgeon far more than the same number of non-diabetics or those suffering from most other chronic diseases. As there are more than 1,000,000 diabetics in the country today, the surgery of the diabetic becomes an everyday problem. The frequent occurrence of gangrene and carbuncles is the chief reason for diabetic surgery.

"The factors which favor surgical success in diabetes are, first of all, an early diagnosis and an early decision to operate. If surgical delays are dangerous under ordinary circumstances, in diabetes they are disastrous.

"The patient should be treated for the operation rather than for the diabetes. Get him successfully through the operation first, and then, if you like, treat him for the diabetes the rest of his life. If you treat him first for the diabetes and second for the operation, the duration of that case of diabetes is apt to be brief.

"But what I consider of far more importance is the number of procrastinating cases of mild infections in mild diabetics, chiefly in their lower extremities, which frequently prove fatal. These conditions develop at a time of life when diabetes is mild, and why should they so frequently be fatal? Consider with what these mild cases of diabetes have to contend. Handicapped by a lingering infection which only too often is allowed to continue for months with kidneys less efficient for throwing off the attack of acidosis; deprived of exercise—that proved stimulus to sugar consumption—for whoever heard of a poor old gangrenous diabetic taking exercise, these patients frequently meet a fourth enemy in the anesthesia."

The management of a surgical diabetic is a fierce combat and the battle should be waged by an internist and a surgeon.

Often the surgeon is the first to recognize the diabetic condition. It is common knowledge that infections, carbuncles, and ulcers often occur in the first year of diabetes, and the patient, not knowing that he has a diabetes, consults the surgeon. Or the patient suffers an accident, a contusion, a laceration, or fracture, and the disease is diagnosed by the surgeon.

The surgeon at this point errs in assuming the responsibility of diabetic management except in cases of emergency, and should call as soon as possible to his side an able internist.

The internist, in our experience, often procrastinates in obtaining the judgment of the surgeon as regards infection and the vascular status of the extremity. Delay leads to major amputations, to sepsis, or coma.

Infections in diabetics decrease sugar tolerance, and often a chronic gall-bladder or appendix which exacerbates causes great fluctuations in the diabetic's insulin dosages and food requirements. Such the internist can eliminate by advising an appendectomy or cholecystectomy.

Both internist and surgeon have duties to each other as well as to the patient.

The surgeon has the right to demand strict surveillance of the patient's hyperglycemia, diet, insulin dosage, repeated urine analysis, blood chemistry, acidosis, and cardiorenal systems.

The internist should only employ a surgeon who can recognize and treat dehydration, infections, who is expert in his choice of anesthesias, who can work with local anesthesia as well as with general, and, above all, one who respects tissues. The greatest causes of postoperative wound infections and complications, such as thrombosis and embolism, are ragged incisions, traumatized tissues, pulling on structures, and too tightly tied ligatures and sutures.

Diabetics divide themselves into three classes of surgical patients: (1) Conditions common to diabetics, such as carbuncle, infections, and gangrene of the extremities.

(2) Emergencies, such as acute abdomen, compound fractures, mastoid, etc.

(3) Operations of election, such as hernia, cholelithiasis, etc.

In the first two the surgeon may not have time to consult an internist, but he should remember that all diabetics are potential comas, especially when an infection exists and after any operative procedure or an anesthetic. The surgeon must combat the acidosis by burning up sugar in the patient with insulin and by avoiding dehydration.

Before all operative procedure we therefore give hypodermoclysis, and 300 to 500 c.c. of orange juice, oral or per rectum, with insulin hypodermically to oxide the glucose.

N. B. Foster[1] points out that the surgical patient is usually fat, a coma prospect, that dehydration causes fever, and fever causes acidosis, and that milk is the best food for the surgical patient until the operation is over and the urine is sugar free.

The postoperative condition of the surgical patient is often such that food cannot be retained because of vomiting or on account of necessary postoperative treatment. Starvation increases acidosis. The human can feed only poorly on his own protein and fat. Starvation acidosis must be avoided by postoperative use of glucose and insulin. Foster also states that the amount of sugar which can be given by the blood-stream is relatively small in a long struggle, and that the glucose is best introduced per rectum in acute surgical conditions.

The postoperative insulin dosage also fluctuates continuously in an acute diabetic surgical condition, especially in the presence of nausea, vomiting, anorexia, shock, and of infection. To watch the insulin it is most practical to examine the urine every four hours for sugar, and especially for diacetic acid. A trained nurse especially experienced with diabetics is a great asset in this type of patient.

If a patient has a hyperglycemia and acidosis, why not use his own sugar without introducing glucose? Such is possible, but it is safer, in order to avoid hypoglycemia, to introduce a known quantity of glucose. Likewise it is well to state that urine analysis, although more practical than waiting for a blood-sugar, is not accurate. The patient may be a renal diabetic or have a temporary traumatic or psychic glycosuria, under which

[1] Jour. Amer. Med. Assoc., 84, 572–576, February 26, 1925.

conditions the patient would enter into insulin shock if insulin were given alone to reduce the acidosis.

Sugar itself is no contraindication against emergency operations in the absence of acidosis, although Foster says that patients with hyperglycemia of more than 0.35 per cent. or a CO_2 combining power of the blood plasma of less than 40 volumes per cent. cannot be expected to survive any operative procedure. Patients with hyperglycemia above this amount and without acidosis often die of postoperative infection. Patients without hyperglycemia but with more than this amount of acidosis are inclined to pass into coma.

Lesions of Extremities.—This subject has been well covered by F. A. Collier and P. L. Marsh.[1]

Classification (Collier and Marsh):

Ulcer.
Infections:
1. Soft parts.
2. Osteomyelitis.
3. Osteomyelitis and gangrene.

Gangrene:
1. Uninfected (dry).
2. Infected (moist).

The common sites for early infection in diabetics is from a perforating ulcer on the plantar surface as a result of paring nails, especially the fourth or fifth digit, and under the malleoli. I wish to add eczematoid dermatitis, formerly known as ringworm, of the toes. I have seen two severe phlegmons of the leg within the last six months. The condition is increasing in men who frequent the locker rooms of golf clubs and gymnasiums.

Infections in diabetics have the following characteristics: Their extent is more difficult to determine than in normals, since a diabetic is more tolerant of pain. I have theorized that the cause of this phenomena might be the acidosis, which makes him apathetic, as in the condition of shock.

Diabetic infections have a great tendency to burrow, necrosing tendons and rapidly producing an osteomyelitis.

[1] Jour. Amer. Med. Assoc., 85, 168–171, July 18, 1925.

Metastatic infections (from carbuncle especially) and blood-stream invasion are early and insidious.

A large percentage of infections of the extremity begin with blood-vessel occlusion, and if not so, are often associated with such vascular involvement as to predispose to gangrene.

The patient today shows a typical infection of the lower extremity as seen in diabetes. We are far from being satisfied as regards his infection. The emergency of his condition only allows us to attack the lesion as an infection. We are sparring for time. In the next few days, as Dr. Julius Novak, our medical resident, reduces the hyperglycemia, I will determine by an *x*-ray and a Pachon oscillometer the condition of his blood-vessels and also the presence of an osteomyelitis.

If gangrene complicates this foot, or if the infection extends upward and involves the bone and the vascular supply shows deficiency, we will rapidly proceed to amputate.

Carbuncle.—The mortality of this lesion is high in diabetes.

I have one suggestion to make: I have abandoned any crucial incisions or flap methods in the treatment of large carbuncles either in diabetics or non-diabetics.

My results warrant continuation of this principle. A flap is a source for septic absorption, delays granulation, and often leaves an uncosmetic scar, defeating its very purpose.

Excise the carbuncle in its entire extent, and graft later if necessary. In carbuncles of the neck, extending from ear to ear and from the hairline to the prominence of the seventh cervical vertebra, I have seldom used grafts, and have obtained in a short period of three to four weeks good repair and function.

Anesthetic.—It is the opinion of most clinicians, including Coller, Foster, Sielig, Joslin, and others, that ether and chloroform should not be used. They produce acidosis, rise in blood-sugar, induce vomiting, are lipoid solvents, produce tissue changes, and add greatly to the burden of the diabetic.

Nevertheless the Mayo Clinic recommends ether. Fitz shows that this clinic uses less ether in the average operation and that their operating time (diabetic gangrene amputations) is shorter.

Laboratory investigations also taboo ether and chloroform.

I quote Yates and Raine,[1] "During and after anesthesia there are abnormal variations in the blood's acid balance." Leake and Hertzman,[2] Stander,[3] and numerous others have reported these changes. Our findings agree with theirs. There is an increase in the hydrogenion concentration, a decrease in alkali reserve as measured by the carbon-dioxid combining power, an increase in sugar, an increase in lactic acid, and usually an increase in phosphates. Chloroform and ether produce the greatest change, while that caused by nitrous oxid is inversely proportional to the percentage of oxygen. Ethylene causes the least change in any of these blood constituents.

Stander[4] has shown that anoxemia produced by breathing an atmosphere of 7 per cent. oxygen lowers the carbon-dioxid combining power and raises the blood-sugar.

Therefore an anesthetic suitable to the situation in diabetes must avoid the following results:

1. Nausea and vomiting (ether).
2. Tissue changes (ether, chloroform, nitrous oxid).
3. Pulmonary complications (ether).
4. Decrease in oxygen-carrying power of the blood, and thereby reduction of the carbon-dioxid combining power of the blood plasma (ether and chloroform by destruction of red cells, nitrous oxid by oxygen insufficiency, and even ethylene if used without 15 to 20 per cent. oxygen).

Ethylene is the ideal general anesthetic. Our experiences with it as an anesthetic at the Augustana Hospital has been satisfactory, especially when combined with novocain-adrenalin solution to obtain muscular relaxation.

Where ethylene is not to be obtained our experiences dictate us to use local anesthesia, infiltration, nerve-block, and, where necessary, parasacral combined with caudal anesthesia.

The writer has employed nerve block in about 10 cases at the Cook County Hospital in midthigh amputations in diabetic

[1] Annals of Surgery, vol. 87, January, 1928.
[2] Jour. Amer. Med. Assoc., 1924, vol. xxxii, p. 1162.
[3] Amer. Jour. Obst. and Gyn., 1926, vol. xii, p. 633.
[4] Ibid., p. 663.

gangrene, using morphin and sometimes scopolamin an hour before amputation.

In only one did we find it necessary to avoid psychic shock, to use nitrous oxid with about 20 per cent. oxygen.

Report (January 21, 1928).—The patient shown December 30, 1927 is still in the hospital. The infection is under control. The *x*-ray showed no bone involvement and no gangrene.

The course, however, has been stormy. The blood-sugar readings are as follows:

12/30/27	365
1/6/28	320
1/9/28	375
1/11/28	300
1/12/28	230
1/18/28	166
1/20/28	176

It is interesting to note that the first real signs of granulation and resolution with drop in temperature began about January 12th, when the blood-sugar was reported down to 230, or 0.23 per cent.

CLINIC OF DR. ALBERT H. MONTGOMERY

PRESBYTERIAN HOSPITAL

I. INTUSSUSCEPTION

THE patient that I wish to show you is this little Italian boy, eight months of age, who was brought to the clinic an hour ago. The pediatricians, who examined him there, were told by his parents that the baby was taken sick about forty-eight hours before with pain in the abdomen, which was intermittent and colicky in character. Shortly after the onset of the pain the child vomited and this has recurred several times. Yesterday he passed a stool containing blood, and there have been several stools since consisting of a little blood-stained mucus.

Now, if we place the child on the table in a good light and look at the abdomen carefully, you can see that it is not distended and is apparently smooth and even. As we watch it I think you can see some moving folds showing, and as they become more pronounced the child becomes restless and begins to cry. These so-called intestinal patterns are simply visible peristaltic waves due to the effort of the bowel to propel its contents beyond an obstruction. The intestinal patterns have now disappeared and the child is quiet again. As I palpate the abdomen it feels soft and non-resisting. Apparently it is not tender and the child pays no attention to what I am doing, but has a far-off, preoccupied look that I have noted in other cases of this kind, and which is quite unlike the curiosity that a child usually displays to whatever is going on immediately about him.

He is a well-developed baby, but he appears to be somewhat apathetic. As I continue to palpate his abdomen I can easily feel a definitely outlined, sausage-shaped mass here on the left side. It is hard and smooth and extends from the pelvic brim vertically upward to the level of the umbilicus. The mass is

only slightly movable from side to side. Now if I insert my finger into the rectum, the anal sphincter feels relaxed. By pressing on the abdominal mass from above with my other hand, my finger in the rectum can feel a hard mass in the lumen of the bowel. As I withdraw my finger you can see some bloody mucus, which resembles currant jelly, on my glove finger. You will notice also that some of the same material is being discharged from the anus. I wish to call your attention particularly to this bloody mucus on rectal examination, for I feel that it is a sign of great importance in making a diagnosis of intussusception, especially in those cases where no tumor mass can be felt.

In this child the diagnosis is easily made, for clinically he presents the classical picture of an intussusception. This condition has probably been present since the onset of the abdominal pain about forty-eight hours ago. The outlook, therefore, is not very good, as the bowel is probably badly damaged from interference with the circulation for such a long time.

We will proceed to operate on this child without further delay. I think ether is the best anesthetic for these patients, so we will use it rather than ethylene or local anesthesia. The field of operation can be prepared while the child is going to sleep. I wish to try out in this case a little procedure suggested by Dr. Farr of Minneapolis. He has found that if a small amount of air is introduced into the rectum, the invaginated bowel can often be partially reduced so that an intussusception that has extended over to the sigmoid can often be reduced back to the ascending colon by slight air pressure. It then lies easily within the surgeon's reach through a right rectus incision. As you know, the method of reducing an intussusception by fluids under gravity pressure led into the rectum and colon is a very old and dangerous procedure. Frequently in these patients the bowel is so friable in places that it is torn by the force of the injected fluid, and the outcome is usually fatal. In order to be absolutely safe in using air pressure this method should not be attempted until everything is in readiness, as we are now, to open the abdomen. To introduce the air we will use a good sized catheter to which is attached a hand bulb taken

from a blood-pressure apparatus. Now I will place my hand on the abdomen so that I can feel the tumor while my assistant, who is not scrubbed up, slips the catheter into the rectum and grasps the air bulb. As the air enters the bowel I can feel the tumor mass move upward and now over to the right in the region of the hepatic flexure. This method seems to be fairly safe for if the air pressure in the bowel is at all strong, the air easily escapes around the catheter at the anus. Now the tumor is readily exposed through this right rectus incision that I am making and, with my fingers in the abdomen, I can feel the intussusception. By milking it down a little more I can bring the mass into the wound opening.

The intussusception can now be seen very plainly. The ileum is apparently infolded into the ascending colon. By carefully milking the tumor downward it continues to unfold and now you can see the appendix and cecum appear. There is still about 4 inches of ileum invaginated into the colon, and apparently it is firmly fixed by a plastic exudate, for it resists any further unfolding in spite of the rather firm pressure that I am making against the apex of the invaginated part. I do not think it would be good judgment to use any greater force, for the colon seems to be stretched almost to the tearing point and the invaginated ileum is apparently firmly adherent to the colon near the ileocecal valve. This is the baffling situation that we so frequently encounter in these cases of intussusception of more than twenty-four hours' duration. It is now a serious question as to what procedure we should follow. In these infants resection of the bowel carries a mortality of almost 100 per cent. I can sew the ileum and colon together above and below the mass and leave the intussusception outside of the abdomen as in the Mikulicz operation. After the extraperitoneal mass was removed, we would have an ileostomy which would have to be closed later. Although the Mikulicz's method is fairly safe from the standpoint of infection, and does not produce as much shock as a resection, yet it is too formidable for these little people and the mortality rate is very high. For some time I have been thinking of trying an operation that has been suggested to me

by the manner in which nature occasionally cures one of these apparently hopeless cases. In rare instances patients like this one have cured themselves by a sloughing of the invaginated portion while the plastic exudate has anastomosed the two portions of the bowel at the intussusception ring without permitting any leakage. It seems to me that such a procedure might

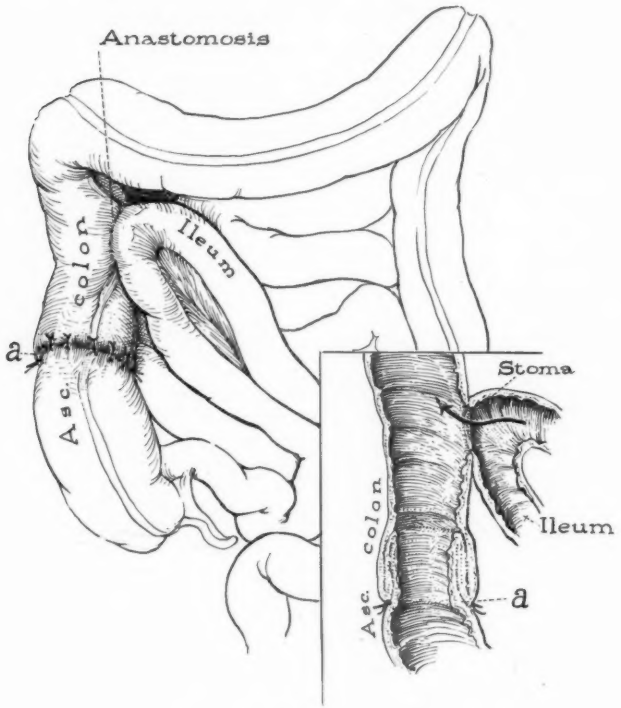

Fig. 215.

be tried in this case. I will begin by placing a few interrupted silk Lembert sutures about the intussusception ring to reinforce the plastic exudate at that point. Next, in order to avoid obstruction, it would seem wise to do a short-circuiting around the intussusception. I will, therefore, make a lateral anastomosis

between the ileum about 5 inches above the mass and the ascending colon a few inches below it. This step completes our operation and we will close the abdomen carefully layer by layer, using strong tension sutures in addition. The structures of the abdominal wall are not very strong in infants and evisceration can occur if proper precautions are not taken to secure a firm closure. The child is in fairly good condition and he will be put to bed and given 250 c.c. of normal salt solution by hypodermoclysis.

Subsequent Course.—The child's convalescence was less stormy than I anticipated. Feedings of milk, cereal, and glucose solutions were started two days after operation, and after one gastric lavage the baby retained all of the food. An attack of bronchopneumonia appeared on the fifth day after operation, but it cleared up within six days, and the child's convalescence otherwise was uneventful. It is interesting to note that, although the stools were watched carefully, no evidence of sloughing tissue was seen. The child was discharged from the hospital in good condition thirty days after operation. At the last report, two months later, he was having no trouble.

Comment.—The successful result obtained in this case has encouraged me to try this procedure again in those cases where the intussusception cannot be completely reduced by manipulation. I am fortified in my opinion by a recent report of Sommers in the March, 1927 number of Surgery, Gynecology, and Obstetrics. He used a similar procedure in cases of strangulated hernia where a portion of the bowel was not visible. Instead of doing a resection, he invaginated the damaged bowel down into the healthy portion beyond, and held it in place by a row of sutures at the neck of the invagination, as I did. However, he did not make a short-circuiting lateral anastomosis in any of his cases. He employed this operation in 7 cases, of which 5 were successful.

II. INTUSSUSCEPTION PRODUCED BY A SMALL MECKEL'S DIVERTICULUM

THE next case that I wish to call your attention to is that of M. C., a little white girl, two years and three months of age, who entered the Presbyterian Hospital on the service of Dr. Parmelee on November 9, 1926, at 10 A. M. This child's trouble began with vomiting twenty-four hours before, which continued up to the time of her admission to the hospital. The material vomited consisted of food and mucus for the first few hours, but after that it began to be of a brown color which grew darker as the vomiting continued. On the day of admission the child had a large liquid stool which was reddish brown, and another stool of the same type two hours later.

The child was seen by Dr. Parmelee shortly after the passage of the first bloody stool. She did not have a history of pain and he was unable to palpate a tumor mass in the abdomen, but because of the continuous vomiting and the blood in the stool he felt very suspicious of the presence of an intussusception and sent the child immediately to the Presbyterian Hospital for further examination. After her arrival, Dr. A. D. Bevan was asked to see her, and he very kindly suggested that I should also be called in consultation. When we examined the child with Dr. Parmelee, it was at once apparent that the girl was acutely ill and somewhat dehydrated. She was restless and trying to vomit, but did not seem to be in pain. Her general physical examination was negative except for the abdomen, which was slightly tender, and gave a feeling which was distinctly suggestive of a mass under the lower half of the right rectus muscle. The abdomen was not tympanitic and no intestinal patterns could be seen on the abdominal wall. Rectal examination was negative except for the finding of some blood-stained mucus on the finger of the examiner's glove.

We felt, as a result of our findings, that the clinical picture could be explained best by a diagnosis of an intussusception.

An adenoma of the bowel had to be considered, as tumors of that type may cause bloody stools in children, but usually such tumors do not give symptoms of marked obstructive vomiting such as occurred in this case. The same observation would hold true of the diagnosis of a bleeding ulcer in Meckel's diverticulum.

Within a few minutes after the diagnosis was made the child's stomach was washed out and she was brought to the operating room. Under ether anesthesia the abdomen was opened through a right rectus incision. Before the peritoneum was incised the tumor mass could be seen clearly beneath the incision. It proved to be an intussusception about 6 inches long in the lower portion of the ileum. By manipulation of the mass it could be reduced without difficulty. When the invagination was finally unfolded a small button-shaped tumor about 2 cm. in diameter was found at the place in the bowel where the intussusception started. Evidently this small tumor was the cause of the intussusception.

An attempt was made to dissect out the little tumor mass from the bowel wall, but in doing so the knife opened into a cyst-like cavity in the tumor. A large number of white particles resembling rice bodies poured out of the cavity. A portion of the tumor was removed for microscopic examination and the cavity was obliterated and closed by a few interrupted catgut stitches. The abdominal incision was then carefully closed in layers with catgut and silk.

The postoperative course was good for the first twenty-four hours, but after that the child vomited everything that was taken. The vomitus finally became somewhat bloody and the temperature began to rise rapidly. It finally reached 108° F., when the child died in coma forty-eight hours after operation.

A necropsy showed a plastic exudate in the peritoneal cavity, but cultures from this were sterile, so that it was simply the normal exudate that follows all operations in the abdomen. From the clinical picture of vomiting and hyperpyrexia it is evident that this is one of those fatal cases of high intestinal toxemia. In common with obstruction of the bowel from all other causes these patients with an intussusception produce a very toxic

fluid in the duodenum and upper jejunum. When the obstruction is relieved by unfolding the invaginated bowel this toxic material passes down to the lower bowel, where absorption occurs.

If the resulting toxemia is severe enough the patient soon develops the characteristic hyperpyrexia and succumbs. Death may occur from this cause as early as six hours after operation. Unfortunately, too, it occurs in some cases, such as this one of ours, which would seem to have a most favorable outlook at the time of operation.

It has been suggested that an ileostomy should be done at the operation or afterward, to drain off this toxic fluid. However, these little patients do not stand that procedure very well and its use has not improved the mortality percentage. Probably the best treatment is to wash this toxic fluid out of the stomach and bowel by the repeated use of the stomach- and colon-tubes. Many clinicians think that this free lavage has saved some of these otherwise fatal cases.

Microscopic examination of the sections which were made of the cyst wall, that was opened at the time of operation, showed a mucous membrane lining similar to that which is present in the small intestine. The tumor mass then was an enterocystoma and, from its location in the ileum, it probably represented Meckel's diverticulum. In this case I feel that the intussusception which started at this point was probably due to the presence of this small Meckel's diverticulum.

In looking over the records of the Children's Memorial Hospital I found that 31 cases of intussusception had been treated in the period from 1921 to 1927. All of these patients were white children, 22 boys and 9 girls. The youngest child was two months of age, the oldest was three years. Of the 31 patients, 27 were under one year of age, and 12 of these were less than six months old. In this series, therefore, the patients were mainly boys in the first year of life.

In studying the clinical picture of these patients I found that the onset was sudden in 30 of this group and gradual in only 1. Pain, usually of the colicky type, was present in 20, absent in 6, and not mentioned in 5 cases. Blood in the stools

was a more frequent finding, as it was present in 28 of the 31 cases. The presence of an abdominal tumor is usually easy to demonstrate, as these children do not have a rigid wall, but the mass was only found in 21 and could not be palpated in 10. The tumor mass could be felt by rectal examination in 13 patients, in 9 nothing could be felt, and in 9 others the results of rectal examinations were not given. The presence of visible peristalsis or intestinal patterns on the abdominal wall was mentioned in only 2 cases. I hardly think it was looked for in most cases or the incidence would have been higher.

The treatment employed in every case was immediate operation as soon as the diagnosis was made. In one case, while the pediatrician was making a diagnosis, the patient was given an enema which reduced the intussusception. Of the other patients, 30 in all, which were subjected to operation, the intussusception was disinvaginated in 23 instances, resulting in 15 recoveries and 8 deaths. Two patients died from rupture of the bowel while attempting to disinvaginate the intussusception. In another patient the mass was disengaged with great difficulty and an ileostomy was done, but the patient did not survive. It was found necessary to do a resection of the bowel in 2 patients and death ensued in both cases. The results might have been better if the Mikulicz two-stage method of resection had been used instead of the usual one-stage operation. A lateral anastomosis without resection, to short-circuit the intussuscepted mass, was done on 2 patients, and both recovered. One was the patient whose case I discussed in detail above. The other was a patient who had an old intussusception with fibrous adhesions between the entering and receiving loops of the intussusception. The bowel was healthy but partially obstructed at this place, so an ileocolostomy was done.

The final results in the 30 operated cases were 16 recoveries and 14 deaths. I feel that the number of recoveries could have been increased by using the Mikulicz operation in the 2 cases where resection was required and also in the 2 other cases where the bowel ruptured in the efforts to disengage the loops.

The length of time that the intussusception has existed has

always been an important factor in the prognosis. All of our cases began in patients who were not in the hospital. Nine of the patients came to the hospital during the first twenty-four hours of their trouble, and of these, 6 recovered and 3 died; 9 entered during the second day of their trouble, and of these, 4 recovered and 5 died; 5 patients entered during the third day, and of these, 2 recovered and 3 died. The increase in the mortality is very noticeable, running from 33 per cent. in the first day to 60 per cent. in the third day. From this period on the outlook seems to change, for the patients who come in after the third day have either a very loosely infolded loop of bowel, or they have a chronic intussusception that folds and unfolds repeatedly, or one that is firm and fixed with fibrous adhesions. There were 8 patients in this group, and 5 of these recovered and 3 died, a mortality of 37.5 per cent.